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A journal of systematic and evolutionary
entomology since 1858



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AUSTRALIAN, MELANESIAN AND MICRONESIAN *ACROPSILUS* MIK (DIPTERA: DOLICHOPODIDAE)

Bickel, D. J., 1998. Australian, Melanesian, and Micronesian *Acropsilus* Mik (Diptera: Dolichopodidae). – Tijdschrift voor Entomologie 141: 1-17, figs. 1-21. [ISSN 0040-7496]. Published 30 November 1998.

The Australian, Melanesian, and Micronesian species of the genus *Acropsilus* Mik (Diptera: Dolichopodidae) are revised, and comprise eleven species: *Acropsilus protractus* Robinson (Solomon Islands, New Guinea, trop. Australia), and ten newly described species: *A. albitibia* (trop. Australia, New Guinea, Solomon Islands, Vanuatu), *A. bobarti* (Irian Jaya, Solomon Islands), *A. colmani* (Papua New Guinea), *A. kuranda* (Queensland), *A. malaita* (Solomon Islands), *A. maprik* (Papua New Guinea), *A. nigricornis* (Solomon Islands, New Guinea, Queensland), *A. putosa* (Papua New Guinea), *A. toma* (Papua New Guinea), and *A. udor* (Micronesia: Truk). Some species are widely distributed in the Australasian tropics.

Acropsilus is known only from the Old World, and is particularly rich and often abundant in moist tropical habitats. The entire genus is reviewed and redefined, and its phylogenetic position is discussed. *Acropsilus* is close to the Oriental genus *Griphomyia* and both genera are tentatively referred to the Peloropeodinae, a subfamily which requires redefinition.

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Key words. – Diptera, Dolichopodidae, *Acropsilus*, Australia, Melanesia, Micronesia.

The genus *Acropsilus* Mik comprises small-sized dolichopodids. Although this genus initially appears to be rather nondescript, males of many species are easily recognised by their elongate ivory-white cerci, which project out from a pedunculate hypopygium. Closer examination reveals a number of uniquely derived features which define the genus, and it has not been readily placed in any of the traditional dolichopodid subfamilies.

Previously six species had been described from widely separated locales in Europe, Tadzhikistan, West Africa, the Seychelles, Sumatra and the Solomon Islands. However, mass trapping methods, particularly malaise and water traps, reveal the genus to be abundant and rich in the Indo-Malayan and Australasian wet tropics. This paper considers the fauna of Australia, Melanesia and Micronesia, and treats eleven species, ten of which are newly described. Two species, *Acropsilus protractus* and *A. albitibia* are widespread throughout Melanesia and northern Australia (figs. 20, 21).

MATERIALS AND ACKNOWLEDGEMENTS

This study is based on material from major world collections. Institutional abbreviations for material

cited follows, and I thank the respective curators and support staff for the loan of specimens.

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|------|--|
| AMS | Australian Museum, Sydney – M. Moulds; |
| ANIC | Australian National Insect Collection, CSIRO, Canberra – P. Cranston; |
| BPBM | Bernice P. Bishop Museum, Honolulu – N. Evenhuis; |
| CAS | California Academy of Sciences, San Francisco – P. Arnaud; |
| CMNH | Carnegie Museum of Natural History, Pittsburgh – C. Young; |
| CNC | Biosystematics Research Institute, Agriculture Canada – J. Cumming; |
| NMWC | National Museum of Wales, Cardiff. – J. Deeming; |
| USNM | National Museum of Natural History, Smithsonian Institution, Washington, D. C. – F. C. Thompson; |
| ZMUC | Zoological Museum, University of Copenhagen – V. Michelsen. |

S. Bullock drew the genitalic figures. C. E. Dyte provided notes and specimens. P. Grootaert provided valuable comments on an early draft of the manuscript. This research was supported by Australian Biological Resources Study (A.B.R.s.) grants 85/0921 and 87/5905.

METHODS

Drawings of genitalia were made with a camera lucida attached to a compound microscope. The left lateral view of the hypopygium or male genital capsule is illustrated for most species. In describing the hypopygium, 'dorsal' and 'ventral' refer to morphological position prior to genitalic rotation and flexion. Thus, in figures showing a lateral view of the hypopygium, the top of the page is morphologically ventral, while the bottom is dorsal. Morphological terminology follows McAlpine (1981) and Cumming et al. (1995). Common features are listed in the introductory descriptions and are not repeated in species descriptions unless needing clarification. Measurements are in millimeters and were made on representative dry specimens. Body length is measured from the base of the antennae to the tip of the seventh abdominal segment. Wing length is the perpendicular distance to the apex from an imaginary extension of the humeral crossvein; wing width is measured from the junction of R_1 with the costa to the opposite side of the wing, perpendicular to the wing's long axis. The CuAx ratio is the length of the m-cu crossvein/distal section CuA. The position of features on elongate structures such as leg segments are given as a fraction of the total length, starting from the base. The relative lengths of the podomeres should be regarded as representative ratios and not measurements. The ratios for each leg are given in the following formula and punctuation: trochanter + femur; tibia; tarsomere 1/ 2/ 3/ 4/ 5.

The following abbreviations and terms are used: mssc – Male secondary sexual character(s), the non-genitalic characters found only on the male body; I, II, III: pro-, meso-, metathoracic legs; C, coxa; T, tibia; F, femur; ac, acrostichal setae; ad, anterodorsal; av, anteroventral; dc, dorsocentral setae; dv, dorsoventral; hm, postpronotal setae; np, notopleural setae; pa, postalar setae; pd, posterodorsal; pm, presutural supra-alar setae; pv, posteroventral; sa, postsutural supra-alar setae; sr, presutural intra-alar setae; t, tarsus; t_{1-5} , tarsomeres I to 5.

SYSTEMATIC PART

Genus *Acropsilus* Mik

Acropsilus Mik (1878: 6). Type species: *Chrysotus niger* Loew 1869: 298, monotypy.

Description

Male. – Body length ranges from 1.0–2.3 mm, but most species about 1.3–1.6.

Head. – Dorsal postcranium flat to slightly concave; male eyes distinctly separated by face and

clypeus; eye facets enlarged anteriorly and ventrally; clypeus usually with four setae: pair midcentral shorter setae, and pair of stronger distal setae (as in fig. 15); strong verticals and strong diverging ocellars present; postverticals represented by 4–5 short setae, continuation of postorbital; first flagellomere variably covered in microtrichia; arista apical, and varies from arising on entire outer curvature of first flagellomere (fig. 15) to arising within distinct indentation on the outer curvature (fig. 4); arista with tiny pubescence, and longer than head height; proboscis (fig. 18) with 6 geminate pseudotracheae; epipharyngeal armature with 2 prongs, and dorsal projection with is weakly sclerotised, and adjacent to which are three thorn-like setae.

Thorax. – Usually rather short, and ratio of length/width about 1.3 (fig. 17); proepisternum with some short setae near posterior margin, and strong seta just dorsad of CI; posterior slope of mesonotum slightly flattened but not depressed; ac absent; 5 dc present, comprising 4 stronger posterior dc which decrease in size anteriorly, and with additional very weak dc anteriormost, on anterior slope of thorax; 1 pa, 2 sa, anterior much shorter than posterior, 2 sr, 2 npl, 1 hm, 1 pm present; posterior mesonotum with distinct transverse fold just anterior of scutellum; median scutellar seta strong, lateral present as weak tiny hair; postscutellum with distinct median longitudinal mound.

Legs. – Mostly yellow; CI and CII with short pale anterior hairs; CII and CIII each with short lateral seta; leg I usually without distinctive setation; FII without distinct true subapical anterior seta, although sometimes some subapical setae may appear slightly stronger; FII with subapical pv seta; TII with strong ad-pd pair at $\frac{1}{4}$, strong ad at $\frac{3}{5}$, and with strong ventral apical, and with coronet of short setae; FIII without subapical anterior seta, but with weak subapical pv seta; TIII with short ad-pd pair at $\frac{1}{4}$, and often with dorsal setae on distal half; male III_t sometimes somewhat swollen with ventral row of hairs (mssc).

Wing (fig. 16). – Membrane hyaline; R_{2+3} ends in anterior margin at $\frac{5}{6}$; R_{4+5} just anterior to apex; R_{4+5} and M subparallel; M without flexion or "bosse alaïre"; anal vein absent; anal angle weak; CuAx ratio near 0.3.

Abdomen. – Usually dark brown; tergal setae not strongly developed; male tergum 1 wide (fig. 17), and distinctly wider than thorax, especially noticeable in dried specimens; hypopygium pedunculate (fig. 1); segment 7 prolonged with distinct elongated tergum and sternum separated by membrane; sternum 8 with distinctive inverted Y-shaped carina; hypopygial foramen left basolateral; hypandrium and aedeagus both short and emerging at angle near base of epandrium; hypandrium broad and apically upcurved,

and basally fused with epandrium; aedeagus rather short and slightly curved, and often with notched phallus; ventral margin of epandrium with 2 epandrial setae; epandrial lobe raised from ventral margin and externally overlapping digitiform surstylar arms; subepandrial sclerite well-developed, curved and resting between cerci, and often with group of strongly pedunculate distal setae; cercus usually white-ivory coloured and subtriangular, and bearing pale setae.

Female. – Similar to male except lacking MSSC and as noted: face and clypeus more widely separated, and facets of uniform size; clypeus always with 4 setae; in species where male first flagellomere deeply incised, female less incised; III_t, unmodified; female tergum I not noticeably wide; oviscapt (figs 3, 4) divided into two hemitergites, each with crest of four spine-like setae, and bearing elongate digitiform process and stalked group of pedunculate setae.

General remarks

Acropsilus is a distinctive dolichopodid genus known only from the Old World. Based on the species treated below and descriptions, the genus has the following set of diagnostic characters: clypeus of females and most males with four projecting setae; pair midcentral shorter setae, and pair of stronger distal setae; arista apical; posterior slope of mesonotum slightly flattened but not depressed; ac absent; 5 dc present; posterior mesonotum with distinct transverse fold just anterior of scutellum; R₄₊₅ and M subparallel; male tergum I wide, and distinctly wider than thorax; hypopygium pedunculate: segment 7 elongate; sternum 8 with distinctive inverted Y-shaped carina; hypandrium basally fused to epandrium; epandrial lobe raised from ventral margin and externally overlapping digitiform surstylar arms; subepandrial sclerite well-developed, curved and resting between cerci, and often with pedunculate distal setae; cercus usually white-ivory coloured and prominent; oviscapt divided into two hemitergites, each with a crest of 4 spine-like setae, and bearing elongate digitiform process and stalked group of pedunculate setae.

Acropsilus is particularly rich in the moist Afrotropical, Oriental and tropical Australasian regions, where many species undoubtedly await description. However, species are also known from western Europe and even at elevations of 1300 m in Tadzhikistan. Specimens are frequently taken in malaise and water (pan) traps, especially in tropical lowlands. In the Ivory Coast, Coutourier (1978) noted that *A. eburneensis* was abundant throughout the forest-savannah mosaic during the rainy season, but confined to gallery forests during the dry season. Similarly, in northern Australia, *Acropsilus* species are abundant and widespread during and after monsoonal rains, but are confined to permanent water during the drier periods.

Males of many species have bright ivory-white cerci, which may function in sexual signalling. Here it should be noted that *Acropsilus albitibia* has ivory-white tibiae I and II (MSSC), which possibly augment the function of the cerci. However, P. Grootaert (pers. comm.) notes that many undescribed species from Thailand have short cerci and greatly enlarged hypopygia.

In the Australasian tropics, *Acropsilus protractus* and *A. albitibia* are particularly widespread throughout Melanesia and northern Australia (figs. 20, 21). Three species occur in Australia, where the genus is confined to the monsoonal tropics and the Queensland coast south to the Tropic of Capricorn. *Acropsilus* is known as far east as Vanuatu, and considering its presence in the isolated Micronesian Truk Group, it probably is readily dispersed.

Checklist

Acropsilus includes the following species:

- albitibia* sp. n. Australia (Queensland, Northern Territory, Western Australia), Indonesia (Irian Jaya), Papua New Guinea, Solomon Islands, Vanuatu
- boharti* sp. n. Indonesia (Irian Jaya), Solomon Islands
- colmani* sp. n. Papua New Guinea
- eburneensis* Coutourier, 1978: 222. Ivory Coast
- errabundus* Lamb, 1922: 403. Seychelles
- igori* Negrobov, 1984: 1111. Tadzhikistan
- kuranda* sp. n. Australia (Queensland)
- malaita* sp. n. Solomon Islands
- maprik* sp. n. Papua New Guinea
- minutus* Hollis, 1964: 276. Indonesia (Sumatra).
- niger* Loew, 1869: 298 (*Chrysotus*). Hungary, western Europe, northern Africa, St. Helena I
- nigricornis* sp. n. Solomon Islands, Australia (Queensland), Indonesia (Irian Jaya)
- protractus* Robinson, 1963: 830. Solomon Islands, Australia (Queensland, Northern Territory, Western Australia), Indonesia (Irian Jaya), Papua New Guinea
- putosa* sp. n. Papua New Guinea
- toma* sp. n. Papua New Guinea
- udot* sp. n. Micronesia (Truk)

The *protractus* group of species (*Acropsilus protractus*, *A. boharti*, *A. colmani*, *A. kuranda*, *A. malaita*, and *A. minutus*) all have an incised, pubescent first flagellomere. I have seen additional species from the Philippines (BPBM), Sabah and Peninsular Malaysia (AMS) and Taiwan (CMNH) which have antenna and hypopygia similar to *A. protractus*, and the group is rich in the Oriental-Australasian tropics. Possibly the West African *A. eburneensis* also belongs in this group.

Acropsilus errabundus from the Seychelles is distinctive for being longer (body length 2.3-2.4, whereas most *Acropsilus* are 1.3-1.6), and the male has elongate legs and thorax, giving it a rather gracile and almost medeterine appearance. As well, the male It has a ventral row of short setae, not found in other *Acropsilus*, and it has eyes which join across the face so that the characteristic clypeal setae absent (they are present on the female, however). Finally, FIII of at least the male has an isolated anterior seta at $\frac{3}{5}$, which I regard as a MSSC, not a true anterior preapical seta. I have examined a male paratype from the Seychelles, Mahé (BMNH) and males from Silhouette, Corgate Ridge, 500 m (AMS).

I have not seen specimens of the Palaearctic *Acropsilus igori*. However, Negrobov's (1984) description does not note the presence of setae on the clypeus, nor the presence of a Y-shaped carina on sternum 8. As well, the hypopygial figure does not indicate the prominent cerci which are so distinctive on congeners. Possibly this species belongs elsewhere.

Morphological notes

Acropsilus is a well-defined genus, and most species conform to the general description given above. Morphological characters which relate to the taxonomic placement of *Acropsilus* are considered below.

I. Autapomorphies

1. Male sternum 8 has a distinctive inverted Y-shaped carina (e.g. fig. 1). This carina is present on all the species I have examined, and is an autapomorphy for the genus. I know of no other dolichopodid genus with a similar structure.

2. The epandrial lobe in most *Acropsilus* species lies subparallel with and externally overlaps the surstyli (fig. 1).

3. The male tergum 1 is distinctly wider than succeeding segments, and wider than the thorax (fig. 17), on all species.

II. Other Character States

4. The subepandrial sclerite between the cerci is prominent, and often has a group of strongly pedunculate distal setae (e.g. fig. 1). Various other dolichopodid subfamilies (e.g. Dolichopodinae) also have well-developed subepandrial sclerites.

5. The clypeus of females and usually males has four projecting setae: pair midcentral shorter setae, and pair of stronger distal setae (as in fig. 15). Strikingly, the New World Atlantic coastal *Nanomyina barbata* (Aldrich) has similarly positioned setae (see fig. 5, Robinson & Vockeroth 1981). *Nanomyina* also has an apical arista, but has 2 rows of ac and a rather short hypopygium (I have not seen specimens). This configuration of clypeal setae therefore is probably homo-

plamous. As well, some other dolichopodid genera also have clypeal setae but in different configurations, for example, as a female secondary sexual character (fssc), in species close to *Syntormon flexible* Becker, and in some undescribed Australian *Sympycnus* species.

6. Posterior mesonotum has a distinct transverse fold just anterior of scutellum. This structure was noted by Ulrich (1980), and also occurs in Diaphorinae.

Systematic position

Acropsilus has been assigned variously to the Sympycninae, Peloropecodinae, or left *incertae sedis*. Of all established subfamilies, *Acropsilus* superficially appears to be close to the Medeterinae, with which it shares postabdominal similarities (an elongate segment 7 forming an external peduncle for the hypopygium), apical arista, hypandrium basally fused to epandrium, and reduced leg setation. However, *Acropsilus* lacks the two strong apomorphic features which define the Medeterinae: postcranium dorsally concave and posterior mesoscutum strongly flattened. Therefore it should be kept out of that subfamily.

In a recent paper, Grootaert & Meuffels (1997) described the Oriental genus *Griphomyia*, and noted its similarity to *Acropsilus*. The two genera share a number of characters: body length mostly less than 2 mm; dorsal postcranium flat; male eyes distinctly separated by face and clypeus; strong verticals and strong diverging ocellars present; thorax rather short and wide; posterior slope of mesonotum slightly flattened but not depressed; 5 dc present; femora II and/ or III with rather weakly developed subapical anterior seta; legs weakly bristled; similar venation; hypopygium pedunculate; abdominal segment 7 prolonged, and separated into distinct tergum and sternum; hypandrium and aedeagus both short and emerging at an angle near base of epandrium; subepandrial sclerite (= 'dorsal appendage' in Grootaert & Meuffels 1997) well-developed; female oviscapt divided into two hemitergites, each with crest of spine-like setae and with elongate digitiform process subtended by pedunculate setae.

In summary, there are strong similarities among *Griphomyia* and *Acropsilus*, in overall habitus (see fig. 1 in Grootaert & Meuffels 1997), female oviscapt, and especially the male postabdominal structure (compare figures in this paper with those in Grootaert & Meuffels 1997). The obvious differences between the two genera (aristal position, presence/absence of acrostichals, clypeal setae, and anal vein) are minor and not of subfamilial significance. The two genera might be regarded as sister taxa and certainly belong in the same subfamily. Grootaert & Meuffels place both in the Peloropecodinae. However, I am not entirely sure of the definition of the Peloropecodinae, and *Peloropecodes* itself has a strikingly different male

postabdomen to the two genera considered here. Only provisionally would I place *Acropsilus* and *Griphomyia* in the Peloropecodinae, pending further investigation of that subfamily.

KEY TO MALE ACROPSILUS FROM AUSTRALIA,
MELANESIA AND MICRONESIA

The following small-sized dolichopodid taxa are sympatric with *Acropsilus* in the Australasian region, and can be distinguished as follows:

A. *Cryptophleps* species also have an apical arista and lack ac setae, but all have a broken vein M, lack the m-cu cross vein, and have an encapsulated hypopygium.

B. Sympycninae of similar size have strong anterior preapical setae on FII and FIII, ac setae usually present, often a distal ad setal comb on TI, a dorsal arista and an encapsulated hypopygium.

C. Medeterinae also have a pedunculate hypopygium and apical arista, but have a distinctly concave dorsal postcranium, a strongly flattened posterior mesonotum, and lack the wide male tergum 1.

This key to *Acropsilus* is difficult and most species, apart from a few with obvious MSSC, require a genital-ile preparation for accurate identification.

1. Cercus clavate, distally expanded with apex at least four times wider than base2
 - Cercus elongate, more or less digitiform, with apex not more than twice basal width3
2. Antenna mostly orange-yellow with only the tip of the first flagellomere dark brown; TIII with strong dorsal seta at $\frac{7}{8}$; cercus, expanded and clavate, subtriangular, and bearing distal row of strong long pale setae, and with dorsal setose projection. (fig. 12) (Papua New Guinea)
 -*A. maprik* sp. n.
 - Antenna dark brown; TIII with short dorsal setae on distal quarter; cercus, expanded and clavate, subtriangular, and bearing scattered pale setae (fig. 13) (Solomon Islands, New Guinea, Queensland)*A. nigricornis* sp. n..
3. Cercus expanded, elongate and spatulate; subepandrial sclerite broad with 3 strong apical setae (fig. 19) (Micronesia: Truk)*A. udot* sp. n.
 - Cercus not as above4
4. First flagellomere only weakly incised, if at all, so that arista arises on the outer curvature of the first flagellomere (fig. 15)5
 - First flagellomere deeply incised, so that arista within distinct indentation on the outer curvature of the first flagellomere (fig. 4)7
5. Entire antenna yellow, with pale hairs; TI and TII basally yellow, with distal three-quarters distinctly

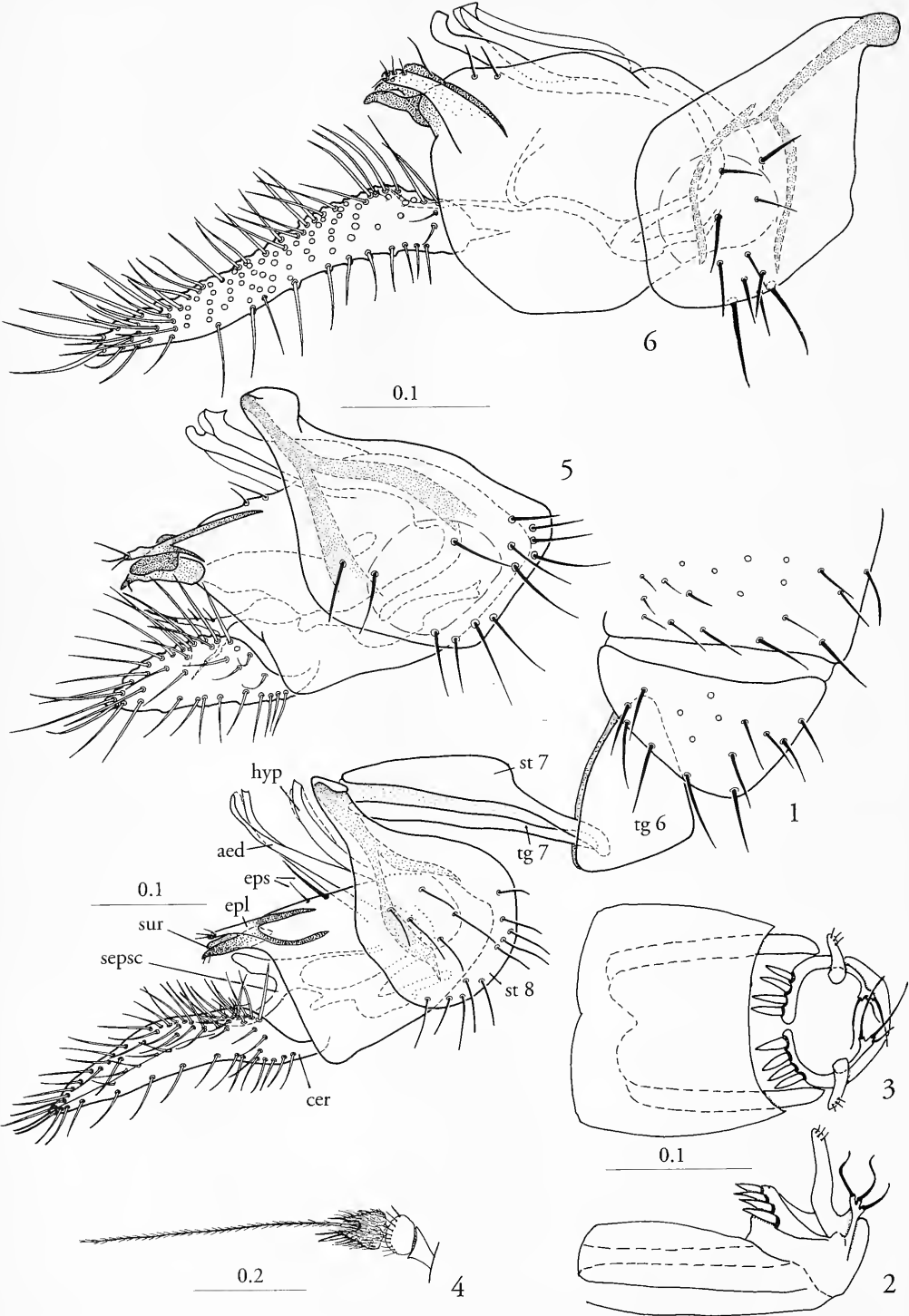
white, and tarsomeres $It_{2,3}$ white; basal epandrial seta twice length of distal seta; cercus relatively short and curved (fig. 14); (tropical Australia, New Guinea, Solomon Islands, Vanuatu)

-*A. albitibia* sp. n.
- At least first flagellomere partially brown; tibiae and tarsi entirely yellow6
- 6. Tibia III with long curved dorsal seta at $\frac{7}{8}$ (fig. 10); antenna dark brown; cercus with strong basal setae and apico-median field of short hairs (Papua New Guinea)*A. toma* sp. n.
- Tibia III with short dorsal setae; scape and pedicel yellow; first flagellomere mostly yellow with only apex infuscated; cercus digitiform and rather uniformly setose (fig. 6) (Papua New Guinea, montane)*A. putosa* sp. n.
- 7. Antenna with at least scape and pedicel partially yellow, and first flagellomere brown8
 - Antenna entirely dark brown9
- 8. Cercus (fig. 11) lobate and elongate, almost twice as long as epandrium, and with distinctive dorsal digitiform projection which bears strong apical seta; mesonotum dull brown-yellow; (New Guinea, Solomon Islands)*A. boharti* sp. n.
 - Cercus (fig. 1) short, about as long as epandrium, and subtriangular; thorax dark brown/metallic green (Solomon Islands, New Guinea, n. Australia)*A. protractus* Robinson
- 9. Epandrial lobe greatly prolonged and lobate, completely covering surstylar arms, and subequal to elongate digitiform cercus (fig. 8) (Solomon Islands)*A. malaita* sp. n.
 - Epandrial lobe relatively short, not much longer than surstyli, and cerci subtriangular and tapering10
- 10. Surstylus with dorsal arm strongly upcurved; cercus elongate, about as long as epandrium (fig. 7) (New Britain)*A. colmani* sp. n.
 - Surstylus with arms subparallel; cercus lobate and short, not extending much beyond apex of surstyli. (fig. 5) (Queensland)*A. kuranda* sp. n.

Acropsilus protractus Robinson
(figs. 1-4, 20)

Acropsilus protractus Robinson 1963: 830. Holotype ♂, SOLOMON ISLANDS: Guadalcanal, Lunga River Valley, 16.ix.1944, J. L. Laffoon (USNM) [examined].

Additional material (all records based on males). – AUSTRALIA. NORTHERN TERRITORY: Berry Springs, 12.42'S 130.59'E, monsoonal rainforest, 15.vi.1954 (ANIC), 4.xii.1991-9.i.1992, 27.ix-30.x.1991, 30.x-4.xii.1991, 9.i-28.ii.1992, malaise, 9-11.i.1992, yellow pans (AMS); Birraduk Ck, 17km WSW of Nimbuwah Rock, 12.19'S 133.13'E, 5.vi.1973; Cooper Ck, 11km SW of Nimbuwah Rock, 1.xi.1972; Kakadu NP, 19km NE of Baroalba Ck



Springs, 12.48'S 132.49'E, 28.x.1972, malaise; East Alligator River, 5 km NNW of, 8-9.vi.1973 (ANIC); Koongarra, 16 km NE of Mt Cahill, 12.52'S 132.51'E, 10.iii.1973; Lee Point, 12.20'S 130.54'E, vi.1964; Magela Ck, 2 km N of Mudginbarry, 15.xi.1972; McArthur River, 2 km SSE of Borroloola, 20.iv.1976; Surprise Ck, 45 km SSW of Borroloola, 15.iv.1976 (ANIC). Kakadu NP, Gubara Springs carpark, 17.i.1992, pans (AMS). – QUEENSLAND: Cockatoo Creek, 11.39'S 142.27'E, 7.ii-2.iii.1993, 12.xi-14.xii.1993, malaise; Coen, 13.57'S 143.12'E, 16.viii-13.ix.1993, malaise; 1 km SE of Mt Cook, 15.30'S 145.16'E, 13.x.1980, malaise; 3.5 km SSW of Mt Baird, 17.26'S 145.04'E, 4.v.1981, malaise; Bellenden Ker Range, 1 km S of Cable Tower 6, 17.x-5.xi.1981, malaise; Cedar Bay NP, Gap Ck, 5 km ESE of Mt. Finnigan, 15.50'S 145.20'E, 150 m, 14.v.1981, malaise (ANIC), 14-15.iv.1994, pans (AMS); Davies Ck & Goldmine Ck, Kuranda, 3.v.1967, gen/sweep; Earl Hill, N of Cairns, 16.48'S 145.42'E, 8.v.1967 (ANIC); Iron Range, 11 km ENE of Mt Tozer, 12.43'S 143.18'E, 11-16.vii.1986, malaise; 3 km ENE of Mt Tozer, 12.45'S 143.14'E, 200 m, 28.vi-4.vii.1986, malaise; 9 km ENE of Mt Tozer, 12.43'S 143.17'E, 5-10.vii.1986, malaise; McIlwraith Range, 11 km NW of Bald Hill, 13.39'S 143.20'E, 520 m, rainforest, 26.vi-13.vii.1989, malaise; Mossman Gorge, 16.26'S 145.16'E, 21-23.iv.1967; Mt Webb NP, 3 km NE of Mt Webb, 15.03'S 145.09'E, 1.v.1981, malaise; Rounded Hill, 15.17'S 145.13'E, 7.x.1980 (ANIC); Miriam Vale district, W of Eurimbula, 24.20'S 151.34'E, 29.iii.1975; Mt Windsor Tableland, Forestry Hut, 16.16'S 145.02'E, 1060 m, 16.iv.1994, pans; Half Ton Ck, NE of Mt Carbine, 16.29'S 145.13'E, 290 m, riverine forest, 18.iv.1994, pans; Waterpark Ck SF, nr Byfield, 50 m, rainforest, 2.xii.1992; Cathu SF, O'Connell River, NW of Mackay, 30m, rainforest, 7.iv.1994, pans (AMS). – WESTERN AUSTRALIA: Carson Escarpment, Drysdale River, 14.49'S 126.49'E, 9-15.viii.1975, malaise (ANIC). – INDONESIA. IRIAN JAYA: Aru Islands, Tengan, 1 km S of Popjetur, 06.48'S 134.04'E, 90 m, 23.vi-11.vii.1994, malaise (NMWC). – PAPUA NEW GUINEA: Maprik, 21-22.iii.1964; Siutmeri, Sepik River, 16.iii.1964; Doa Estate, 80 km W of Port Moresby, 9.ix.1962; Eastern Highlands South, Okapa, 27.x.1964; Okapa, Kaga, 2,100 m, 11.vi.1964; Finisterre Range, Damaindi, Madang Central, 1060 m, x.1964; Butemu III & VIII, Finisterre Range, 1270 m, x.1964 (ANIC); Normanby I., Wamula 29.xii.1988-3.i.1989; Western Prov., Tabubil, 05.15'S 141.13'E, 650 m, 3.x.1993; Bainyik, 20.xii.1963 (AMS); Bougainville: Boku, 4.vi.1956, & Ruisei, N of Tokinoitu, 2.vi.1956 (BPBM). – SOLOMON ISLANDS: Rennell Island, Niupani, 22.viii.1962 (ZMUC); Guadalcanal, v.1944 (USNM); Vella Lavella, Arewana area, 17.xi.1963; Florida Group, Nggela I., Haleta, xi.1975, 0-50m; Kolombangara Island: Ringgi Cove, xi.1976 & Kundulu, SW coast, 10.vii.1959; Guadalcanal, Honiara, 200 m, xii.1975; Guadalcanal, Tadhimbko, 9.xii.1975; Malaita, Auki, 100 m, xii.1975; Malaita, NW, Dala, 11.vi.1964, light trap; New Georgia Group, Gizo I., 200 m, xii.1975, 11.vii.1959; New Georgia, Munda, 15.vii.1959; San Cristobal Island, Maniata, Kira Kira, xii.1975-i.1976; Santa Ysabel, Buala, 26.vi.1960, light trap (BPBM).

Description

Male. – Length: 1.1; wing: 1.1×0.3.

Head. – Vertex and frons dark brown with metallic green reflections and some grey pruinosity; face-clypeus blue metallic green; palp and proboscis brownish; scape and pedicel reddish-yellow to yellow, although sometimes dorsally infuscated; first flagellomere dark brown, rounded, setose, and deeply incised.

Thorax. – Mesonotum dark brown with metallic blue-green reflections, with some grey pruinosity; pleura matt brown; proepisternum with pale longer ventral seta and 2 shorter dorsal setae near posterior margin.

Legs. – Coxae and remainder of legs yellow, although CII sometimes infuscated; CI and CII with short pale anterior hairs; CII and CIII each with short brownish lateral seta; I: 2.0/ 1.5/ 0.7; 0.5; 0.4; 0.2; 0.2; leg I without distinctive setation; II: 2.0/ 2.2/ 0.8; 0.5; 0.3; 0.3; 0.2; TII with strong ad-pd pair at ¼, strong ad at ¾ and apically, and with strong ventral apical; III: 2.2; 2.1; 0.3/ 0.8/ 0.5/ 0.3/ 0.2; TIII with short ad-pd pair at ¼, and dorsal seta at ¾; III_t, somewhat globular and with a few ventral setae.

Wing. – Lower calypter yellow with fan of brown setae; halter yellow.

Abdomen. – Entirely dark brown with sparse short brown setae; hypopygium (fig. 1) brown, with dark brown surstyli, and cream-white cerci; hypopygial foramen left basolateral; hypandrium broad and apically upcurved; aedeagus rather short and slightly curved, and with notched phallus; ventral margin of epandrium with stronger basal and shorter well-separated epandrial setae; epandrial lobe with single apical seta and externally overlapping digitiform surstylar arms; cercus, expanded and clavate, subtriangular, and bearing long pale setae.

Female. – First flagellomere not as deeply incised; oviscapt (figs 3, 4) divided into two hemitergites, each with crest of 4 spine-like setae, and bearing elongate digitiform process and stalked group of pedunculate setae.

Remarks

Acropsilus protractus is widespread in northern Australia, New Guinea and the Solomon Islands (fig. 20), and is particular common in lowland habitats, but occurs to elevations of 2000 m in Papua New Guinea. In Australia, it is found across the monsoonal north, and along the Queensland coast south to the Tropic of Capricorn.

Figs. 1-6. *Acropsilus* species. – 1-4. *Acropsilus protractus* Robinson; 1, male postabdomen, left lateral; 2, female oviscapt, left lateral; 3, female oviscapt, dorsal; 4, male antenna, left lateral. – 5-6. hypopygium and sternum 8, left lateral – 5, *A. kuranda* sp. n.; 6, *A. putosa* sp. n. Abbreviations: aed, aedeagus; cer, cercus; epl, epandrial lobe; eps., epandrial seta; hyp, hypandrium; sur, surstylus; st, sternum; sepsc, subepandrial sclerite; tg, tergum.

Acropsilus protractus has a yellow scape and pedicel in contrast to the dark brown first flagellomere, although in some specimens the dorsal scape and pedicel are infuscated. The legs are entirely yellow. The cerci appear somewhat apically truncated in dorsal view. As well, there is some intraspecific variation in cercal length, and specimens from northern Queensland appear to have slightly shorter cerci than Solomon Island specimens.

Acropsilus kuranda sp. n.
(fig. 5)

Type material. – Holotype, ♂, Paratypes, ♂, 2 ♀, AUSTRALIA. QUEENSLAND: 11 km along Black Mountain, Kuranda State Forest, 20.iv.1967, D.H. Colless (ANIC).

Additional material. AUSTRALIA. QUEENSLAND: ♂, 2 ♀, Bellenden Ker Nat. Park, Bartle Frere track, at junction of 3 creeks, 17.25°S 145.51°E, 200 m, rainforest, 12.iv.1994, pans; ♂, Eungella NP, Crediton Creek, 920 m, rainforest, 30.xi.1992, pans; ♂, 2 ♀, Little Cooper Creek, 16.10°S 145.27°E, 75 m, rainforest, 14.iv.1994; ♂, Mason Ck, nr Cape Tribulation, 16.05°S 145.28°E, 0–10 m, mangroves, 14–15.iv.1994, pans; ♂, Mount Mirinjo, 18 km NW of Innisfail, 25.iv.1980, sweep (AMS); 2 ♂, ♀, Mt Elliot NP, Alligator Creek, 19.30°S 146.55°E, 30, sweep, 8.iv.1994 (CNC); ♂, 2 ♀, Bramston Beach, nr Innisfail, rainforest, 30.iv.1967; ♂, Gillies Hwy, 3.5 km W of Little Mulgrave, 18.iv.1967; 2 ♂, ♀, Lacey Creek, near Mission Beach, 17.54°S 146.06°E, 13–14.v.1980; 3 ♂, 11 ♀, McIlwraith Range, 11 km NW of Bald Hill, 13.39°S 143.20°E, 520 m, rainforest, 26.vi–13.vii.1989, malaise, 3 ♂, The Boulders, NW of Babinda, 17.22°S 145.55°E, 50 m, 10.v.1967, 8.vii.1967; ♂, ♀, Upper Mulgrave River, 16 km from Goldsborough, 9.v.1967; ♂, Wongabel SF, near Atherton, 17.19°S 145.31°E, 5.v.1967 (ANIC).

Description

Male. – Length: 1.3; wing: 1.1 × 0.3.

Head. – Vertex, frons dark brown with metallic blue reflections; face-clypeus metallic green; palp and proboscis brown; antenna dark brown, first flagellomere rounded, strongly setose, and deeply incised (as in fig. 4), with apical arista arising from base of incision.

Thorax. – Mesonotum dark brown with metallic blue-green reflections, and with little pruinosity; pleura matt brown; proepisternum with longer ventral seta and 2 shorter dorsal setae near posterior margin.

Legs. – Coxae and remainder of legs yellow; I: 1.8/ 1.7/ 0.7; 0.5; 0.4; 0.3; 0.3; II: 2.3/ 2.5/ 0.8; 0.7; 0.3; 0.3; 0.2; TII with strong ad-pd pair at ¼, strong ad at ⅓, and with strong ventral apical; III: 2.6; 2.7; 0.3/ 0.8/ 0.5/ 0.3/ 0.2; TIII with short ad-pd pair at ¼, and a few short dorsal setae on distal quarter; III_t, somewhat globular and with a few ventral setae.

Wing. – Lower calypter yellow with fan of brown

setae; halter yellow with dark brown club.

Abdomen. – Entirely dark brown with sparse short brown setae; sternum 8 with setae as figured; hypopygium (fig. 5) brown with dark brown surstyli and cream-white cerci; hypopygial foramen left basolateral; hypandrium broad and apically upcurved; aedeagus rather short and slightly curved, and with notched phallus; ventral margin of epandrium with stronger basal and shorter distal epandrial setae; epandrial lobe with 2–3 apical setae, and externally overlapping subtriangular surstyler arms; subepandrial sclerite Y-shaped with two apical arms, each ending in strong seta; cercus lobate, bearing long pale setae, and not extending much beyond apex of surstyli.

Female. – Similar to male except as noted: eyes slightly more widely separated, and facets of uniform size; first flagellomere not as deeply incised; III_t, somewhat less swollen.

Remarks

Acropsilus kuranda occurs in tropical forests of northeastern Queensland, from the McIlwraith Range of Cape York Peninsula south to Eungella, west of Mackay. Most specimens were taken in the Cairns district. This species is close to the sympatric *A. protractus*, but differs in having the antenna entirely dark brown, a short lobate cercus which doesn't extend much beyond the surstyli, and a more deeply incised first flagellomere.

Acropsilus colmani sp. n.
(fig. 7)

Type material. – Holotype, ♂, Paratypes 5 ♂ 2 ♀, PAPUA NEW GUINEA, New Britain, Amelei Village, Fullerborn Harbour, xii.1988, P H Colman (AMS).

Additional material. – PAPUA NEW GUINEA, ♂, ♀, New Britain, Keravat, Rabaul, 100 m, 15–31.x.1968, N L H Krauss (BPBM); ♂, Kandanggei, Sepik River, 2.iii.1964 (ANIC).

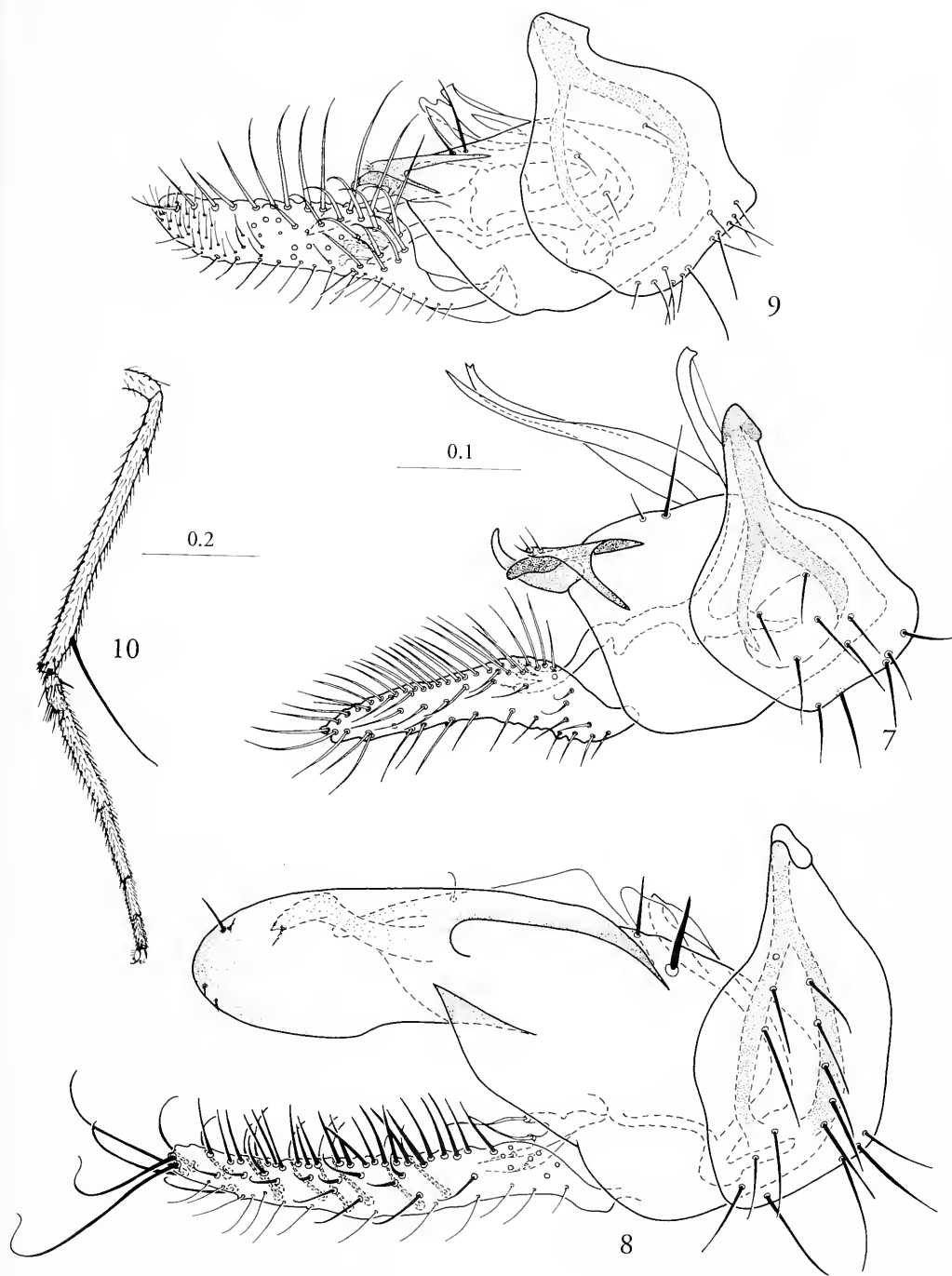
Description

Male. – Length: 1.2–1.3; wing: 1.1 × 0.4.

Head. – Vertex, frons dark brown with metallic green reflections clypeus and face bright metallic green; palp and proboscis brown; antenna uniformly dark brown, first flagellomere rounded, setose, but only shallowly incised.

Thorax. – Mesonotum dark brown with metallic blue-green reflections, and shining, with little pruinosity; pleura matt brown; proepisternum with longer ventral seta and 2 shorter dorsal setae near posterior margin.

Legs. – Coxae and remainder of legs yellow; TII with strong ad-pd pair at ¼, strong ad at ⅓, and with strong ventral apical; TIII with short ad-pd pair at ¼,



Figs. 7-10. *Acropsilus* species. — 7-9, hypopygium and sternum 8, left lateral; 10, male tibia and tarsus III, anterior; — 7, *Acropsilus colmani* sp. n.; 8, *A. malaita* sp. n.; 9-10, *A. toma* sp. n.

and a few short dorsal setae on distal quarter; III_t, somewhat globular and with a few ventral setae.

Wing. – Lower calypter yellow with fan of brown setae; halter yellow with brownish club.

Abdomen. – Preabdomen dark brown with sparse short brown setae, postabdomen mostly light brown except hypopygium with dark brown surstyli and elongate cream-white cerci; hypopygium (fig. 7); hypandrium broad and upcurved apically; aedeagus curved, and with notched phallus; ventral margin of epandrium with well-separated strong basal and shorter epandrial setae; epandrial lobe with short apical setae, and externally overlapping surstylus; surstylus dark brown, with dorsal arm strongly upcurved; subepandrial sclerite cercus with 4 strong apical setae, each on distinct peduncle; elongate and oblong, and bearing pale setae.

Female. – Similar except lack MSSC and as noted: abdomen entirely dark brown.

Remarks

Acropsilus colmani is known from New Britain and mainland Papua New Guinea. This species is close to *A. protractus* and also has a hairy, incised first flagellomere. However, the combination of entirely dark brown antenna, elongate cercus, and upcurved surstyli are diagnostic. This species is named for Phil Colman, who has collected extensively in Melanesia.

Acropsilus malaita sp. n.
(fig. 8)

Type material. – Holotype, ♂, Solomon Islands: Malaita (NW), Dala, 5.vi.1964, light trap, R. Straatman (BPBM).

Description

Male. – Length: 1.3; wing: 1.2×0.3.

Head. – Vertex and frons dark brown with metallic reflections; face clypeus metallic green; antenna dark brown, first flagellomere rounded, weakly setose, and only slightly incised.

Legs. – Coxae and remainder of legs yellow; TII with strong ad-pd pair at ¼, strong ad at ⅓, and with strong ventral apical; TIII with short ad-pd pair at ¼, and short dorsal setae near ⅞; I_t, somewhat globular and with ventral setae.

Wing. – Lower calypter yellow with fan of brown setae; halter yellow with infuscated club.

Abdomen. – Entirely dark brown with sparse short brown setae; hypopygium (fig. 8) with dark brown surstyli, and cream-white cerci; hypandrium broad and apically upcurved; aedeagus rather short and slightly curved; ventral margin of epandrium with very strong basal epandrial seta which is somewhat laterally displaced and shorter distal epandrial seta;

epandrial lobe dark brown, greatly expanded and distally prolonged with some short apical setae, and totally covering the more median surstyli arms, one of which is distally bent; subepandrial sclerite cercus with 4 strong apical setae, each on distinct peduncle; cercus elongate and digitiform.

Female. – Unknown.

Remarks

Acropsilus malaita is known only from the Malaita, Solomon Islands type locality. The greatly prolonged and expanded epandrial lobe and elongate digitiform cercus are diagnostic.

Acropsilus toma sp. n.
(figs. 9-10)

Type material. – Holotype, ♂, Paratypes ♀, PAPUA NEW GUINEA: Mangalese area, nr Toma, SSW of Popondetta, 600 m, ix.1964, R. Pullen (ANIC).

Additional material. – PAPUA NEW GUINEA: ♂, Central Prov., Port Moresby, 29.v.1984 (CMNH).

Description

Male. – Length: 1.3; wing: 1.1×0.3.

Head. – Vertex, frons, face, clypeus dull dark brown; palp and proboscis brown; antenna dark brown, first flagellomere rounded, not densely haired and only weakly incised, with apical arista arising from base of incision.

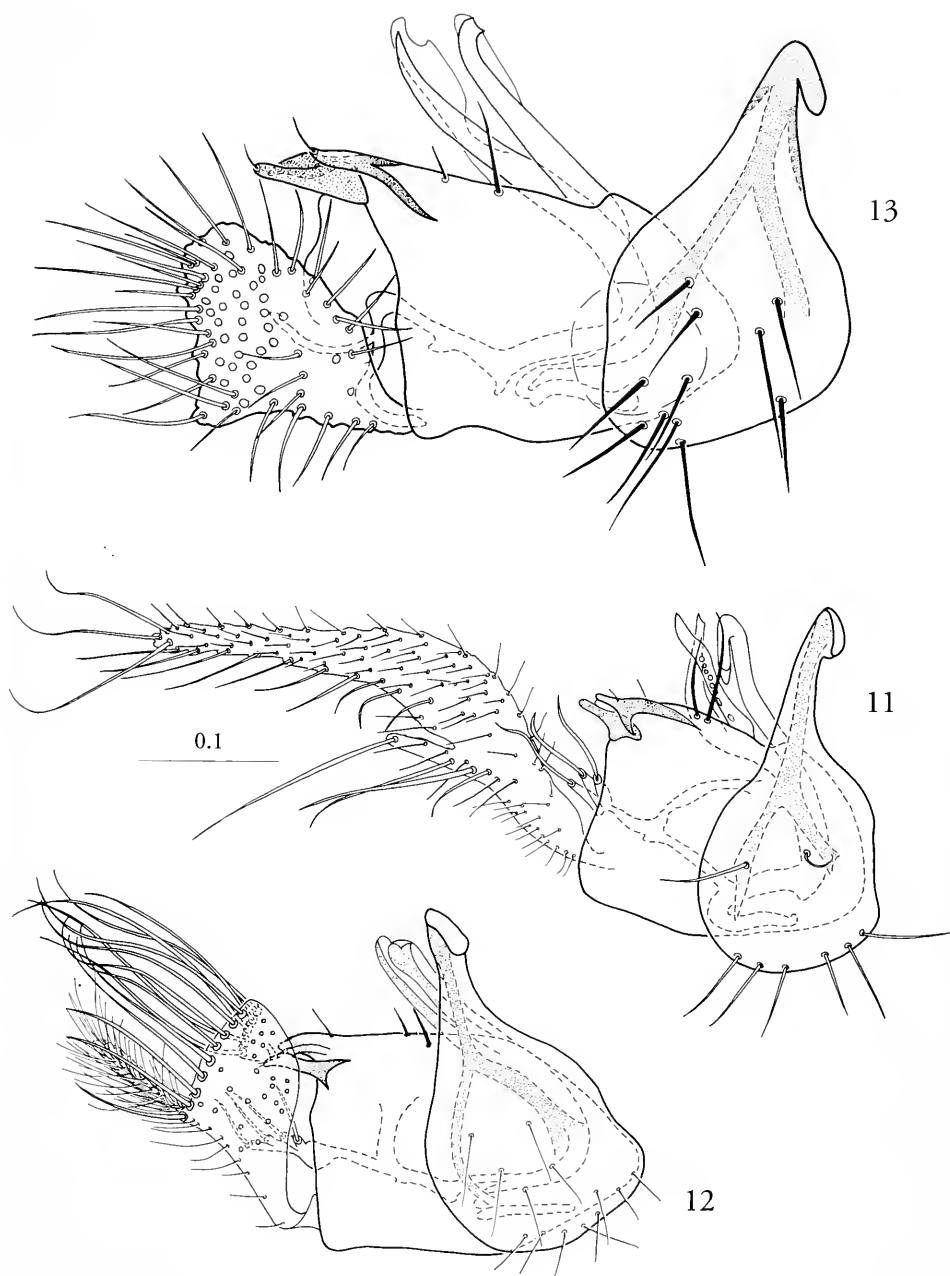
Thorax. – Mesonotum dark brown with some brown pruinosity; pleura matt brown; setae black.

Legs. – Coxae brown but yellowish distally; remainder of legs yellow, although femora somewhat infuscated; TII with strong ad-pd pair at ¼, strong ad at ⅓, and with strong ventral apical; TIII (fig.10) with short ad seta at ½ and with very long curved dorsal seta at ⅞ (MSSC); III_t, somewhat globular and with some ventral setae.

Wing. – Lower calypter yellow with fan of brown setae; halter brownish with dark brown club.

Abdomen. – Entirely dark brown with sparse short brown setae; hypopygium (fig. 9) brown with dark brown surstyli and white cerci; hypandrium broad and apically upcurved; aedeagus curved, and with notched phallus; ventral margin of epandrium with stronger basal and slightly shorter distal epandrial setae; epandrial lobe externally overlapping surstyli arms; subepandrial sclerite curved and elongate, with apical setae; cercus oblong, bearing row of long pale ventral setae and field of strong curved basomedial seta, and with apicomedial field of short hairs.

Female. – Similar to male except as noted: eyes slightly more widely separated, and facets of uniform size; TIII with only short dorsal seta at ⅞.



Figs. 11-13, *Acropsilus* species, hypopygium and sternum 8, left lateral. – 11, *Acropsilus boharti* sp. n.; 12, *A. maprik* sp. n.; 13, *A. nigricornis* sp. n.

Remarks

Acropsilus toma is known from two lowland sites in Papua New Guinea. It is distinguished by the long curved dorsal seta of male tibia III (mssc), and the row of long setae along the ventral border of the oblong cerci.

Acropsilus boharti sp. n.

(fig. 11)

Type material. – Holotype, ♂, Paratypes, ♂, 2 ♀, INDONESIA. IRIAN JAYA, Biak I., 25.iv.1945, G.E. Bohart (CAS).

Additional material. – SOLOMON ISLANDS: ♂, Guadalcanal, Tambalia, 30 km W of Honiara, malaise trap, 21.v.1964 (BPBM).

Description

Male. – Length: 1.2; wing: 1.3×0.4.

Head. – Vertex, frons dark brown with metallic reflections; face-clypeus metallic blue-green; palp and proboscis yellowish; antenna yellowish with first flagellomere slightly infuscated; first flagellomere rounded, strongly setose and incised, with apical arista arising from base of incision.

Thorax. – Mesonotum dull brown-yellow with little pruinosity; pleura yellow.

Legs. – Coxae and remainder of legs yellow; TII with ad-pd pair at $\frac{1}{4}$, strong ad at $\frac{3}{5}$, and with strong ventral apical; TIII with short ad-pd pair at $\frac{1}{4}$, and strong subapical dorsal seta; III_t, somewhat globular and some ventral setae.

Wing. – Lower calypter yellow with fan of brown setae; halter yellow with dark brown club.

Abdomen. – Entirely dark brown with sparse short brown setae; hypopygium (fig. 11) brown with dark brown surstyli and white cerci; hypandrium broad and apically upcurved; aedeagus curved with indented phallus; ventral margin of epandrium with strong basal and distal epandrial setae; epandrial lobe with short setae and externally overlapping rather short surstyler arms; subepandrial sclerite with group of 3 strong setae, each arising from separate long peduncle; cercus elongate and lobate, bearing pale setae, and with distinctive dorsal digitiform projection which bears strong apical seta.

Female. – Similar to male except as noted: eyes slightly more widely separated, and facets of uniform size; first flagellomere not as deeply incised; III_t, somewhat less swollen.

Remarks

Acropsilus boharti is known from two lowland Me-

lanesian sites: Biak Island off northern Irian Jaya, and Guadalcanal, Solomon Islands, but it probably occurs in intervening areas. This species is distinguished by the digitiform projection along the dorsal surface of the elongate cercus. This digitiform projection is longer on the Irian Jaya males (figured) than on the Solomon Island male.

Acropsilus maprik sp. n.

(fig. 12)

Type material. – Holotype, ♂, PAPUA NEW GUINEA: Maprik, 21.iii.1964, D.H. Colless (ANIC).

Description

Male. – Length: 0.9; wing: 1.2×0.4.

Head. – Vertex and frons dark brown, with metallic green reflections; face-clypeus metallic green-bronze; palp and proboscis brown; antenna mostly orange-yellow with only the tip of the first flagellomere dark brown; first flagellomere rounded, setose, and only shallowly incised.

Thorax. – Dark brown with metallic blue-green reflections, and shining, with little pruinosity; pleura matt brown.

Legs. – Coxae and remainder of legs yellow, although FII and FIII slightly infuscated; TII with strong ad-pd pair at $\frac{1}{4}$, strong ad at $\frac{3}{5}$, and with strong ventral apical seta; TIII with short ad-pd pair at $\frac{1}{4}$, and strong dorsal seta at $\frac{7}{8}$; III_t, with ventral row of short hairs (mssc).

Wing. – Lower calypter yellow with fan of brown setae; halter yellow.

Abdomen. – Preabdomen dark brown with sparse short brown setae; postabdomen and hypopygium (fig. 12) mostly yellow, except hypopygium with dark brown surstyli and ivory-white cerci; hypandrium broad and apically upcurved; aedeagus rather short and slightly curved; ventral margin of epandrium with stronger basal and shorter epandrial setae; epandrial lobe with single apical seta and externally overlapping digitiform surstyler arms; subepandrial sclerite with 4 strong, slightly pedunculate setae; cercus, expanded and clavate, subtriangular, and bearing distal row of strong long pale setae, and with medio-dorsal setose projection.

Female. – Unknown.

Remarks

Acropsilus maprik is known only from northern lowland Papua New Guinea. The enlarged clavate cercus with its distal row of strong setae and yellow antennae are diagnostic. This species is close to *A. nigricornis* and both species have clavate cerci.

Acropsilus nigricornis sp. n.
(fig. 13)

Type material. – Holotype, ♂, SOLOMON ISLANDS. New Georgia Group, Gizo I., 0–100 m, ii.1984, N. L. H. Krauss (BPBM).

Additional material. – AUSTRALIA. QUEENSLAND: ♂, Iron Range, nr. Mt Lamond, 20.xii.1971 (AMS); ♂, Mt Webb NP, 3 km NE of Mt Webb, 15.03'S 145.09'E, 2.x.1980, malaise trap (ANIC). – INDONESIA. IRIAN JAYA: ♂, Biak I., 25.iv.1945 (CAS).

Description

Male. – Length: 1.1; wing: 1.0×0.3.

Head. – Vertex, frons, face-clypeus metallic green, dark brown, shining with metallic blue reflections; palp and proboscis brown; antenna dark brown, first flagellomere rounded, setose, and weakly incised.

Thorax. – Mesonorum dark brown with metallic blue-green reflections, and with little pruinosity; pleura matt brown; proepisternum with longer ventral seta and 2 shorter dorsal setae near posterior margin.

Legs. – Coxae and remainder of legs yellow; I: 2.0/1.5/ 0.7; 0.3; 0.3; 0.2; 0.2; II: 2.0/ 2.2/ 0.8; 0.5; 0.3; 0.3; 0.2; TII with strong ad-pd pair at ¼, strong ad at ⅓, and with strong ventral apical; III: 2.2; 2.1; 0.3/ 0.8/ 0.5/ 0.3/ 0.2; TIII with short ad-pd pair at ¼, and a few short dorsal setae on distal quarter; III_t, somewhat globular and with a few ventral setae.

Wing. – Lower calypter yellow with fan of brown setae; halter yellow.

Abdomen. – Entirely dark brown with sparse short brown setae; hypopygium (fig. 13) brown, with dark brown surstyli, and cream-white cerci; hypandrium broad and apically upcurved; aedeagus rather short and slightly curved; ventral margin of epandrium with well-separated stronger basal and shorter epandrial setae; epandrial lobe with single apical seta and externally overlapping digitiform surstyler arms; subepandrial sclerite with distal curved Y-shaped arms; cercus, expanded and clavate, subtriangular, and bearing scattered long pale setae.

Female. – Unassociated.

Remarks

Acropsilus nigricornis is known from the Solomon Islands, Cape York Peninsula, and offshore northern Irian Jaya. The enlarged clavate cercus, dark brown, weakly-incised first flagellomere, and shining metallic blue face are diagnostic.

Acropsilus albitibia sp. n.
(figs. 14–18, 21)

Type material. – Holotype ♂, Paratypes 4♂, 3♀, AUSTRALIA. QUEENSLAND: Iron Range, 3.2 km NE of

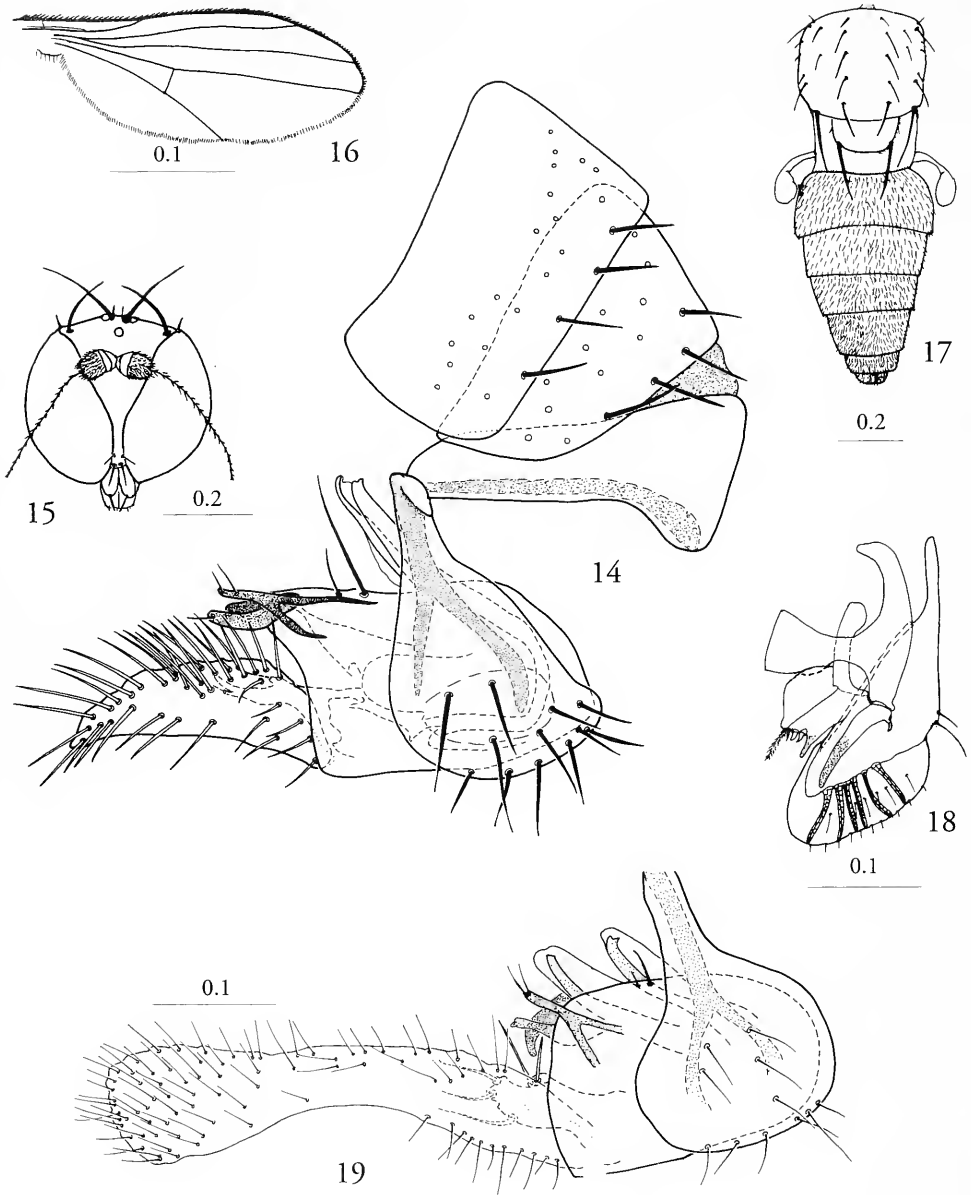
Mt Lamond, 22.xii.1971, D.K. McAlpine & G.A. Holloway. Paratypes, 8♂, 21♀, 1.6 km W of Mt Lamond, 13–23.xii.1971, malaise; 4♂, 2♀, Claudie River, nr Mt Lamond, 12.48'S 143.13'E, 3.vi.1966 (AMS).

Additional material (all records based on males). – AUSTRALIA. NORTHERN TERRITORY: Berry Springs, 12.42'S 130.59'E, monsoonal rainforest, 30.x–4.xii.1991, 4.xii.1991–9.i.1992, malaise (AMS); Darwin, 12.27'S 130.50'E, vi–vii.1958, at light (ANIC); Kakadu NP, Baroalba Ck Springs, 19km NE of Mt. Cahill, 12.48'S 132.49'E, 29.x.1972, malaise & 16.xi.1972, at light (ANIC); Nourlangie Ck, 8 km N of Mt Cahill, 26.x.1972; Lee Point, 12.20'S 130.54'E, vi.1964 (ANIC); Magela Ck, 2 km N of Mudginbarry, 15.xi.1972 (BPBM). – QUEENSLAND: 14 km NW of Hope Vale Mission, 15.16'S 144.49'E, 8.x.1980, malaise; 1 km SE of Mt Cook, 15.30'S 145.16'E, 13.x.1980, malaise; 4 km SSE of Cape Tribulation, 16.06'S 145.29'E, 21–22.xi.1981; 5 km NW of Rounded Hill, 15.17'S 145.10'E, 7.x.1980, malaise; Bamboo Ck, nr Mail, 16.19'S 145.23'E, 25.iv.1967; Cedar Bay NP, Gap Ck, 5 km ESE of Mt Finnegan, 15.50'S 145.20'E, 150 m, 15.v.1981, malaise; Earl Hill, N of Cairns, 16.48'S 145.42'E, 8.v.1967; Gillies Highway, 3 km W of Little Mulgrave, 18.iv.1967; Iron Range, 3 km ENE of Mt Tozer, 12.45'S 143.14'E, 200 m, 28.vi–4.vii.1986, malaise; 9 km ENE of Mt Tozer, 12.43'S 143.17'E, 5–10.vii.1986, malaise; 9 km NW of Mt Tozer, 30–vi–7.vii.1986; Lacey's Ck, nr Mission Beach, 17.54'S 146.06'E, 13–14.v.1980; Station Ck, 7 km WSW of Hope Vale Mission, 15.19'S 145.03'E, 10.v.1981; The Boulders, NW of Babinda, 17.22'S 145.55'E, 50 m, 8.vii.1971; McIlwraith Range, 11km NW of Bald Hill, 13.39'S 143.20'E, 520m, rainforest, 26.vi–13.vii.1989, malaise; Mt Cook NP, 15.29'S 145.16'E, 10.v.1981, 12.x.1980, malaise; Mt Webb NP, 3 km NE of Mt Webb, 15.03'S 145.09'E, 1–2.v.1981, malaise (ANIC); North Maria Ck, nr Silkwood, 17.45'S 146.02'E, 14.xii.1961; Double Mouth Ck, 30 km NE of Heathlands, 11.37'S 142.49'E, 22.iii.1992; Portland Roads, 12.36'S 143.25'E, 14.xii.1971, malaise; Silkwood, 17.45'S 146.01'E, 25.v.1958; Tully River, 17.46'S 145.36'E, 175 m, rainforest, 10.iv.1994, pans; Bertie Ck pump, nr Heathlands, 11.46'S 142.36'E, 21.iii.1992, malaise (AMS). – WESTERN AUSTRALIA: Kimbolton, xi–xii.1982, malaise (ANIC). – INDONESIA: Aru Islands, Trangan, 1 km S of Popjetur, 06.48'S 134.04'E, 90 m, 23.vi–11.vii.1994, malaise trap (NMWC); – IRIAN JAYA: Biak I., 25.iv.1945 (CAS); Oransbari, 28.vii.1962 (BPBM). – PAPUA NEW GUINEA. Central Prov.: Doa Estate, 80 km W of Port Moresby, 2–9.ix.1962 (ANIC); 5 km NW of Brown River Bridge, 6.ix.1984; Aroa River, Aroana Estate, 2.xii.1963, 26.viii.1984; Imbia, nr Maprik, 19.xii.1963 (AMS); Rouna, 300 m, xi.1968; Brown River, dry riverbed, 30.viii.1959 (BPBM). – SOLOMON ISLANDS. Guadalcanal, Honiara, 200 m, xii.1975; Guadalcanal, Poha River, 5 m, 2.vii.1959; Malaita, Auki, 100 m, 18.xi.1957; New Georgia Group, Ghizo I., 200 m, xii.1976, malaise; Rendova Island, Agagana, 13.xi.1970; Dai Island, Bethlehem, 10 m, xii.1972 (BPBM). – VANUATU. Lopevi, Lamen, 100 m, ii.1976 (BPBM).

Description

Male. – Length: 1.2; wing 1.1×0.4

Head. – Vertex and frons dark brown with metallic green reflections; face and clypeus bright metallic green; palp and proboscis brown; antenna entirely red-



Figs. 14-19. *Acropsilus* species. — 14-18. *Acropsilus albitibia* sp. n.; 14, male postabdomen, left lateral; 15, male head, anterior; 16, male wing, dorsal; 17, male thorax and abdomen, posterodorsal; 18, internal mouthparts, left lateral; 19, *A. udor* sp. n., hypopygium and sternum 8, left lateral.

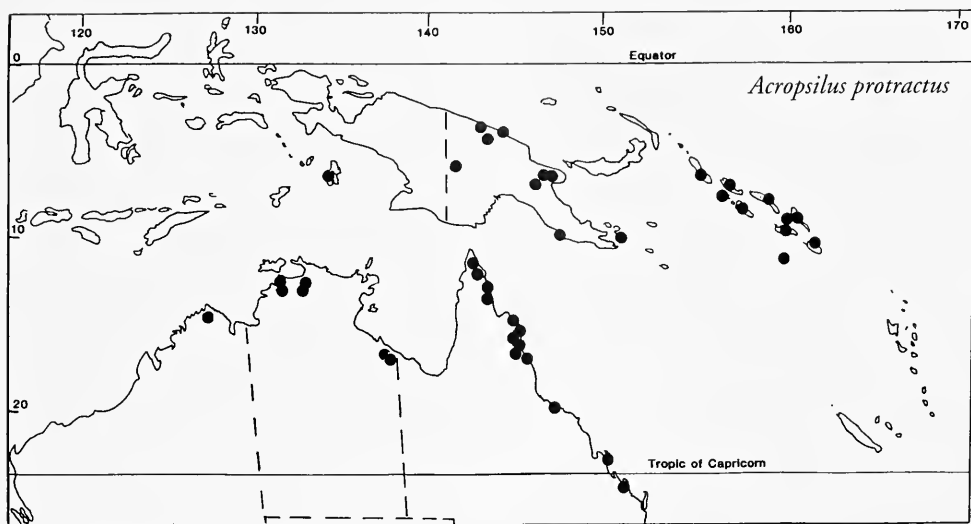


Fig. 20. — Distribution, *Acropsilus protractus* Robinson.

dish-yellow; first flagellomere rounded, globular, with pale apical hairs, but without apical notch (fig. 15).

Thorax. — Brownish with metallic green reflections, with some brown pruinosity over mesonotum and pleura, and with humeral area yellowish; proepisternum with 3 short spaced setae near posterior margin; setae black.

Legs. — Coxae and femora yellow; TI and TII basally yellow, with distal three-quarters distinctly white or ivory coloured (mssc), and especially visible in anterior view, strongly contrasting with yellow ground colour; TIII pale yellow; tarsi mostly yellow, but $It_{2,3}$ white (mssc); CI and CII with short pale anterior hairs; CIII and CIII each with short brown lateral seta; I: 2.7/ 2.2/ 0.8; 0.4; 0.3; 0.4; 0.4; leg I without distinctive setation; II: 3.6/ 3.2/ 1.0; 0.8; 0.4; 0.4; 0.4; FII with short subapical av and pv setae; TII with strong ad-pd pair at $\frac{1}{4}$, strong anterior at and apically, and with strong apico-ventral seta; III: 3.0; 3.4; 0.4/ 1.2/ 0.6/ 0.5/ 0.4; FIII with short subapical av and pv setae; TIII with strong ad and pd at $\frac{1}{4}$, and with strong subapical dorsal seta; III t_1 somewhat globular with short ventral setae.

Wing (fig. 16). — Lower calypter yellow with fan of brown; halter yellow.

Abdomen. — Preabdomen (fig. 17) dark brown with short yellowish setae; postabdomen (segments 6-9) and hypopygium yellowish, except surstyli dark brown and cerci ivory white; hypopygium (fig. 14); hypandrium broad and hood-like; ventral margin of

epandrium bearing very strong basal epandrial seta and shorter distal seta; epandrial lobe digitiform with apical and subapical setae; surstyler arms slightly curved and digitiform; subepandrial sclerite elongate, with basal and distal pedunculate setae; cercus subtriangular and tapering and covered with white setae.

Female. — Similar to male except lack mssc and as noted: face wider; TI and TII entirely yellow; abdomen dark brown.

Remarks

Acropsilus albitibia is found in monsoonal northern Australia, from Cape York Peninsula to the Kimberley district, Western Australia, and widely across lowland Melanesia, from the Aru Islands and mainland New Guinea to the Solomon Islands and Vanuatu (fig. 21).

The ivory-white colour on male tibiae I and II is diagnostic. In addition, most males have similar white tarsomeres 2-3 on leg I, but this is sometimes indistinct, so that tarsus I appears entirely pale yellow. Also it should be noted that in some specimens the white coloration on tibiae I and II is only weakly developed. This might be due to age, state of preservation, or intraspecific variation. Of particular interest, the ivory-white colour on both male legs I and II is identical to the male cercal colour (and the cercal colour of most *Acropsilus* species), and possibly both the legs and cerci are used in courtship display.

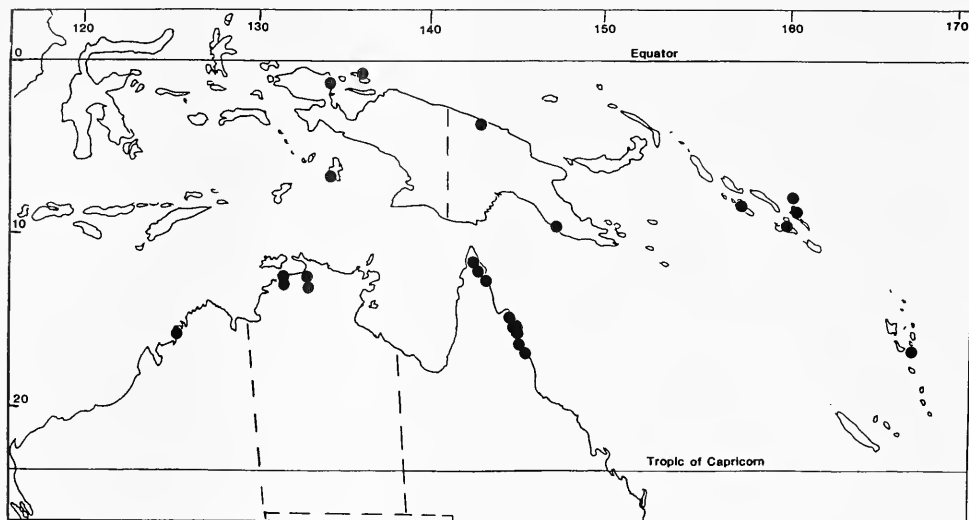


Fig. 21. – Distribution, *Acropsilus albitibia* sp. n.

Acropsilus putosa sp. n.
(fig. 6)

Type material. – Holotype ♂, Paratype ♂ PAPUA NEW GUINEA. Eastern Highlands, Putosa, 2400 m (as 8000 ft.), vii.1968, R. Hornabrook (ANIC).

Description.

Male. – Length: 1.3; wing: 1.6×0.5 .

Head. – Vertex and frons dark brown with metallic green reflections and some grey pruinosity; face-clypeus blue metallic green; palp and proboscis brownish; scape and pedicel yellow; first flagellomere mostly yellow with only apex infuscated, and rounded, not incised, and weakly haired.

Thorax. – Mesonotum dark brown with metallic blue-green reflections, with some grey pruinosity; pleura matt brown; proepisternum in basal third with longer ventral seta and shorter dorsal seta near posterior margin.

Legs. – Coxae yellow, although CII with some basal infuscation; femora mostly brown, and remainder of legs yellow, TII with strong ad-pd pair at $\frac{1}{4}$, strong ad at $\frac{3}{5}$, and with strong ventral apical; TIII with short ad-pd pair at $\frac{1}{4}$, and short dorsal setae at $\frac{7}{8}$; III_t somewhat globular and with a few ventral setae.

Wing. – Lower calypter yellow with fan of brown setae; halter yellow.

Abdomen. – Entirely dark brown with sparse short brown setae; hypopygium (fig. 6) brown, with dark brown surstyli, and cream-white cerci; hypandrium

broad and apically upcurved; aedeagus upcurved; ventral margin of epandrium with subequal basal and distal epandrial setae; epandrial lobe with group of short apical setae; surstylar arms overlapping and digitiform; cercus elongate, digitiform and with pale setae.

Female. – unknown.

Remarks

Acropsilus putosa is known only from the eastern highlands of Papua New Guinea. The elongate digitiform cercus is diagnostic. The antenna is mostly yellow, with the first flagellomere weakly incised, and sparsely haired, and this species is close to *A. albitibia*.

Acropsilus udot sp. n.
(fig. 19)

Type material. – Holotype, ♂ FEDERATED STATES OF MICRONESIA: Truk Group: Udot I, 25.v.1946, H.K. Townes (USNM).

Additional material. – FEDERATED STATES OF MICRONESIA: ♂, Truk Group: Moen I., Mt. Teroken N, 28.xii.1952 (BPBM).

Description

Male. – Length: 1.3; wing 0.9×0.3 .

Head. – Vertex, frons dark brown with metallic green reflections; face and clypeus metallic green; palp and proboscis yellow; scape and pedicel entirely yellow; first flagellomere and arista missing.

Thorax. – Mesonotum brown with little pruinosi-

ty; pleura matt brown.

Legs. – Coxae and remainder of legs yellow; TII with strong ad-pd pair at $\frac{1}{4}$, strong ad at $\frac{3}{8}$, and with strong ventral apical; TIII with short ad-pd pair at $\frac{1}{4}$, and short dorsal setae at $\frac{7}{8}$; IIIr, globular and with some ventral setae.

Wing. – Lower calypter yellow with fan of brown setae; halter yellow.

Abdomen. – Dark brown with sparse short brown setae; hypopygium (fig. 19) brown, with dark brown surstyli, and cream-white cerci; ventral margin of epandrium with stronger basal and shorter distal epandrial setae; epandrial lobe with two apical setae, and externally overlapping digitiform surstyler arms; subepandrial sclerite broad with 3 strong, spaced apical setae; cercus expanded, elongate and spatulate, bearing weak setae.

Female. – Unknown.

Remarks

Acropsilus udot is known only from the Truk Group in the Caroline Islands. The elongate spatulate cercus is diagnostic. Although both specimens are missing the first flagellomere, based on the scape and pedicel, this species seems close to *A. albitibia*.

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BOOK REVIEWS

Zlata S. Gershenson & Sandrine A. Ulenberg, 1998. The Yponomeutinae (Lepidoptera) of the World exclusive of the Americas. – Koninklijke Nederlandse Akademie van Wetenschappen, Verhandelingen Afdeling Natuurkunde, tweede Reeks, Vol. 99. Amsterdam, etc. 250 pp, many figs., 3 colour plates, hardback 25x17,5 cm. [ISBN 0-444-85819-9]. Price NLG 125.00.

This book presents an overview of the Yponomeutinae of the old world, with 233 species, including fossil ones. All the species are listed alphabetically with references, type deposition and information on biology (flight period, hostplants). Some 22 less known species are fully described, with genitalia figures. One new genus and eight new species are described, nine species are transferred to other genera and five new synonyms are established. Three colour plates show 62 species in natural size.

Introductory chapters contain a.o. a historical review, a list of hostplants, a checklist and a list of Yponomeutid genera excluded from this subfamily. Also a key for the 25 listed genera and a key for the species of *Yponomeuta* is provided.

This book is an important basis for any further taxonomic and biological work on this highly interesting group of micro-moths. Especially the supposed ancient relationship with the hostplant family Celastraceae is intriguing. In this light it is to be regretted that the book is not completed with the American species. It is true that even for a 'simple' checklist material ought to be checked, but a mere list, even not checked, of names would have been helpful.

Strong points of the book are the completeness of references in the annotated list, the type-data and hostplant-data, the lists of hostplants and the list of excluded genera.

Some points of criticism are: the absence of generic diagnoses makes it impossible to judge why species are placed in a certain genus; many of the photographed moths are too small, some are hardly recognizable. I personally do not like long citations of references in the check-list and would have preferred short references and a list of full references.

Despite this, the book is recommended for Lepidoptera taxonomists and evolutionists working with this group of insects. I hope the authors will now find time and endurance to continue with the next step: a phylogenetic analysis of this subfamily.

Menno Schilthuizen & Henk Vallenduik, 1998. Kevers op kadavers. – Wetenschappelijke Mededeling KNNV, 222, 148 pp. [ISBN 90-5011-112-2]. Price NLG 29,50 excl. p&p. [Beetles on carrion, In Dutch]

This booklet gives an overview of the Dutch beetles, living on carrion. It includes an identification key and descriptions of 22 species of Histeridae, 16 species of Silphidae and 23 Cholevidae. For these species also distribution maps are provided. For another 10 beetle families short keys are given for carrion feeding genera, or only a short description of the family.

A nice booklet for all entomologists interested in beetles or carrion fauna; also of interest for forensic entomologists.

Johan van Zoest (ed.), 1998. Biodiversiteit. – KNNV Uitgeverij, Utrecht, 212 pp. Hardback 17x25 cm. [ISBN 90-5011-107-6]. Price NLG 59,50 excl. p&p. [Biodiversity, In Dutch]

This book is a general introduction into the subject of Biodiversity for the interested public in The Netherlands. It deals with the various aspects of Biodiversity and has special chapters on ecological background, the natural and artificial landscapes, the vulnerability of species for extinction, the social-economic side of biodiversity and a chapter with the intriguing title 'Single ticket to the bare lands? Rather not.'

The book is well written, and probably will help the public to understand the problems of biodiversity; but readers not familiar with Dutch will not find much in the book; even a summary is missing.

It is curious further that amongst the authors are hardly real specialists of the biodiversity: taxonomists, particularly those of arthropods. May be this is the explanation that some recent publications, even from the same publisher, were overlooked, or at least not cited. Such as the previous book on Biodiversity in The Netherlands (1995) and the recent Orthoptera book (see review on page 48). Instead, distribution data of Orthoptera and Odonata were taken from much older sources, partly out of date. The photograph depicting *Tettigonia viridissima* shows a very young larva, but doesn't mention this, so that laymen probably mistake this for an adult.

The book is only recommended as an introduction, for those familiar with Dutch.

[Erik J. van Nieukerken]

SYSTEMATICS OF THE GENUS *HETEROTHERA*

INOUE (LEPIDOPTERA, GEOMETRIDAE:

LARENTIINAE)

S.-W. Choi, 1998, Systematics of the genus *Heterothera* Inoue (Lepidoptera, Geometridae: Larentiinae). – Tijdschrift voor Entomologie 141: 19-47, figs. 1-57. [ISSN 0040-7496]. Published 30 November 1998.

The genus *Heterothera* Inoue, occurring widely in the Palearctic and in the high mountains of the Oriental region, is revised and twenty-three species are recognized. Nine species are described as new: *Heterothera boenei* Choi **sp. n.**, *H. yunnanensis* Choi **sp. n.**, *H. triangulata* Choi **sp. n.**, *H. eclinosis* Choi **sp. n.**, *H. stamineata* Choi **sp. n.**, *H. obscurata* Choi **sp. n.**, *H. distinctata* Choi **sp. n.**, *H. mussooriensis* Choi **sp. n.** and *H. kurenzovi* Choi, Viidalepp & Vasjurin **sp. n.**, and five new combinations are suggested: *Heterothera tephroptilus* (Fletcher) **comb. n.**, *H. serrataria* (Prout) **comb. n.**, *H. etes* (Prout) **comb. n.**, *H. comitabilis* (Prout) **comb. n.** and *H. undulata* (Warren) **comb. n.** A key and illustrations of adults and genitalia are given. The monophyly of *Heterothera* and the species relationships are discussed. In addition, four poorly known taxa of *Thera* sensu Prout, *T. cyphoschema* Prout (= *atrinotata* Joannis **syn. n.**), *T. exangulata* Warren, and *Pennithera distractata* Sterneck **comb. n.**, are redescribed and the taxonomy of these species is briefly discussed.

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Key words. – Systematics; Geometridae; Larentiinae; *Heterothera*; Palearctic; Oriental.

The genus *Heterothera* Inoue consists of medium-sized geometrid moths in the subfamily Larentiinae, which are widely spread in the Palearctic and Oriental regions. The genus was erected by Inoue (1943) based on the following characters: the absence of uncus, long anal tube, stout and flat saccus, weakly sclerotized costa and a well developed sacculus. The monophyly of the genus *Heterothera* s.s. was first defined by Viidalepp (1980). He listed seven apomorphies for the genus: the bifid saccus, the absence of an uncus, the membranous ductus and corpus bursae without signum, the simple sterigma, the distinct sacculus, the presence of cornuti on the vesica, and the filiform male antenna. Two synapomorphies out of seven, the bifid saccus and the absence of uncus, were unique to *Heterothera* s.s. However, the character 'absence of uncus' was found to be incorrect.

Inoue (1982) proposed a new genus *Viidaleppia* for the species of *Asaphodes* sensu Viidalepp (1980). Later, he (Inoue 1986) described the characters of the genus *Viidaleppia* as: doubly bipectinated male antenna, strongly sclerotized costa and pointed apex of forewing, sclerotized and plate-like sacculus, well developed apical projection of the sacculus, numerous spin-

ular cornuti, well developed sterigma, and a broad ductus bursae.

However, the genus *Heterothera* s.s. was found to be paraphyletic in relation to *Viidaleppia* and the latter was synonymized with *Heterothera* in a cladistic analysis of the Cidariini sensu Herbulot (Choi 1997; see 'Diagnosis and monophyly' for synapomorphies).

Since the works of Prout (1914, 1938, 1941), the taxonomy of *Thera* s.l. has been considerably changed, due to the discovery of many new species and a different analytical approach (e.g. Viidalepp 1980, Choi 1997). As a result of the cladistic analysis, the genus *Heterothera* s.l. is characterized by several derived characters and, based on these, many undescribed species of the genus have been recognized, mainly from southwestern China and northern India. The purpose of the present study is to revise the species of *Heterothera*. While the taxonomy of several poorly known species of *Thera* s.l., such as *T. exangulata*, *T. cyphoschema*, *T. atrinotata* and *T. distractata*, is uncertain, another purpose is to redescribe these species in order to understand their relationships better.



1



2



3



4



5



6

Figs. 1-6. Adults of *Heterothera*. – 1, *H. postalbida*; 2, *H. tephroptilus*; 3, *H. mussooriensis*; 4, *H. undulata*; 5, *H. boenei*; 6, *H. quadrifulva*.

MATERIALS AND METHODS

The study is based on the material from the following museums and private collections:

AMNH, American Museum of Natural History, New York

BMNH, British Museum (Natural History), London

BNHM, Bulgarian Natural History Museum, Sofia

HNHM, Hungarian Natural History Museum,

Budapest

KY, private collection of Katsumi Yazaki, Tokyo

MF, private collection of M. Fibiger, Copenhagen
SNHM, Swedish Natural History Museum,
Stockholm

ZBI, Institute of Botany and Zoology, Tartu
ZFMK, Zoologisches Forschungsinstitut und
Museum Alexander Koenig, Bonn

ZMH, Zoological Museum, Helsinki

ZSM, Zoologische Staatssammlung München,
München.

Examination and dissection of the genitalia, in-

cluding everting the vesica, follow Hardwick (1950), while the terminology of the morphology including the genitalia follows Forbes (1948) and Klots (1970).

SYSTEMATICS

Heterothera Inoue, 1943

Heterothera Inoue, 1943: 12. Type species: *Cidaria postalbida* Wileman, 1911 (original designation).

Viidaleppia Inoue, 1982: 283. Type species: *Cidaria quadrifulta* Prout, 1938 (original designation).

Diagnosis and monophyly

Species of *Heterothera* are characterized by the sclerotized costa and the triangular sacculus of the male genitalia, the well developed sterigma and the greatly modified ductus bursae of the female genitalia. The species of *Heterothera* have male antenna and a wing pattern similar to the species of *Pennithera* Viidalepp, *Praetheria* Viidalepp and *Thera* Stephens. However, *Heterothera* can be distinguished from other taxa by the triangular and sclerotized sacculus, several large spinular cornuti, the well developed sterigma and the greatly modified ductus bursae.

The monophyly of *Heterothera* s.l. has been defined by Choi (1997), and seven synapomorphies support the clade of *Heterothera*: (1) small process of sacculus (or harpe), (2) long hairs on the cornutus, (3) medially invaginated saccus, (4) scattered cornuti, (5) semi-circular lamella antevaginalis, (6) relatively thick ductus bursae, and (7) sclerites on the wall of the ductus bursae.

Description

Antenna of male filiform (*postalbida*, *yunnanensis*, *sororcula*, *obscurata*, *eclinosi*), bipectinate with short pectinations (*dentifasciata*, *distinctata*, *quadrifulta*, *taigana*, *undulata*) or with long pectinations (*incerta*, *tephroptilus*, *consimilis*, *mussooriensis*, *firmata*, *serraria*, *serrataria*, *kurenzovi*, *hoenei*). Frons smooth, covered with blackish or dark ochreous and whitish scales. Labial palp variable in length, often about twice as long as eye diameter. Interantennal fillet dark brownish in colour, often distinct by white scales. Legs blackish or dark ochreous and whitish, with distinct whitish tibial joints. Metathorax mediodorsally white, with blackish tufts. Forewing ground colour varies; basal part dark, occasionally white, basal line dentate, slanted, occasionally smooth, vertical; dorsum between basal and antemedial lines with a black horizontal streak (*postalbida*, *sororcula*, *tephroptilus*, *etes*, *mussooriensis*) or with a vertical blackish bar (*yunnanensis*, *taigana*) or with a large dot (*quadrifulta*, *consimilis*); antemedial line medially indented, occasionally not indented, strongly waved; postmedial line costally

slanted, bent, often toothed, medially bulged; central fascia variable in width, form constant throughout fascia or thinner at middle and dorsum, discoidal dot blackish, often indistinct by uniting with costal part of antemedial line (*etes*, *firmata*), dorsum distinct with blackish scales (*incerta*, *obscurata*, *dentifasciata*, *distinctata*, *triangulata*, *quadrifulta*, *undulata*, *stamineata*); subterminal line sometimes present, blackish, scalloped (*serraria*, *serrataria*, *kurenzovi*); termen blackish or dark ochreous. Hindwing ground colour whitish (*postalbida*, *yunnanensis*, *sororcula*, *incerta*, *dentifasciata*, *distinctata*, *triangulata*, *consimilis*, *quadrifulta*, *serraria*, *serrataria*, *kurenzovi*, *hoenei*, *stamineata*, *eclinosi*), yellowish white (*etes*, *firmata*), greyish or blackish (*obscurata*, *tephroptilus*, *taigana*, *undulata*, *comitabilis*); discoidal dot usually small, often large; postmedial line blackish, usually medially bulged; termen sometimes tinged with blackish (*incerta*, *triangulata*, *consimilis*, *quadrifulta*, *serrataria*, *kurenzovi*, *undulata*) or with waving subterminal line (*serraria*).

Male genitalia. – Uncus weakly sclerotized, tapered at bottom or slender, length varies from moderate (*postalbida*) to long (*yunnanensis*). Tegumen smaller than the total length of vinculum and saccus, dome-shaped or triangular. Saccus concave or medially invaginated (*postalbida*, *dentifasciata*, *yunnanensis*, *obscurata*, *serraria*, *serrataria*, *kurenzovi*, *undulata*, *eclinosi*), broad and flat at bottom (*incerta*, *tephroptilus*, *distinctata*, *consimilis*, *taigana*) or round (*hoenei*, *firmata*). Juxta sclerotized, broad, occasionally juxta and transtilla form a long tubular structure (*postalbida*, *sororcula*); anellus lobe conspicuous, varies in shape, from simple and digitiform (*postalbida*, *sororcula*, *obscurata*, *distinctata*, *consimilis*, *firmata*, *taigana*, *serrataria*, *kurenzovi*, *undulata*, *hoenei*) to large and triangular (*yunnanensis*, *eclinosi*) or small and nipple-shaped (*incerta*, *tephroptilus*, *dentifasciata*, *quadrifulta*, *serraria*), usually long hairs present at apex. Valva distoventrally expanded, with long hairs; costa sclerotized, varies in width, distally wider (*postalbida*, *sororcula*, *obscurata*, *tephroptilus*, *dentifasciata*, *distinctata*, *consimilis*, *taigana*, *undulata*, *eclinosi*), medially expanded (*yunnanensis*, *incerta*, *quadrifulta*, *hoenei*, *mussooriensis*) or medially and distally expanded (*firmata*, *serraria*, *serrataria*, *kurenzovi*); sacculus distinct, usually sclerotized, with a distal process (*yunnanensis*, *incerta*, *tephroptilus*, *dentifasciata*, *distinctata*, *consimilis*, *firmata*, *quadrifulta*, *taigana*, *serraria*, *serrataria*, *kurenzovi*, *hoenei*, *eclinosi*) or two processes (*postalbida*, *sororcula*, *obscurata*, *undulata*). Aedeagus sclerotized, slender, cylindrical or basally tapered to an apex, distally scobinated, often large spinular processes around neck present (*incerta*, *kurenzovi*); vesica tubular or small, sac-like, cornuti usually present, variable in size, with from small to large spines.

Female genitalia. – Papillae anales weakly sclero-

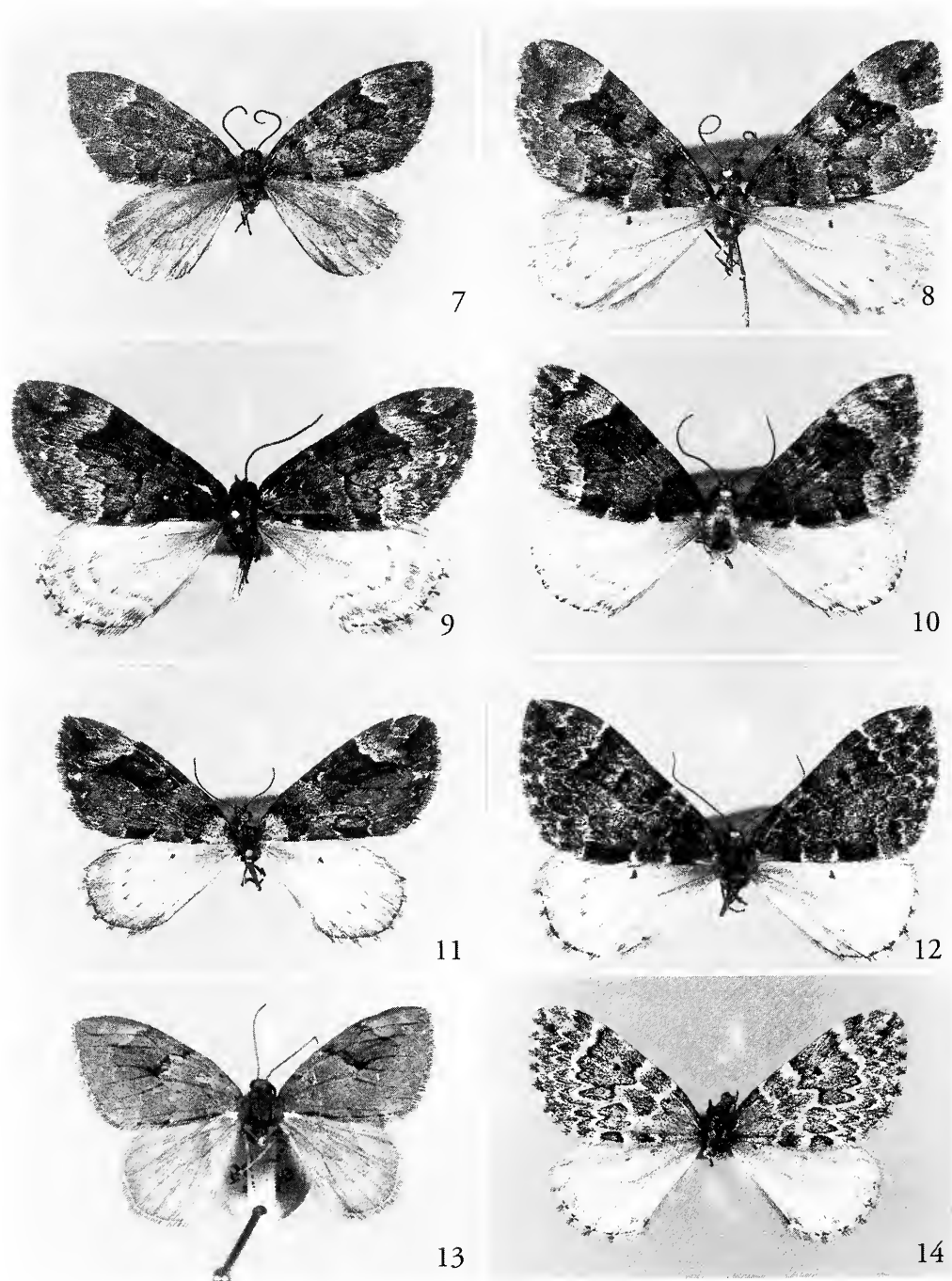


Fig. 7-14. Adults of *Heterothera*. – 7, *H. obscurata*; 8, *H. distinctata*; 9, *H. yunnanensis*; 10, *H. eclinosis*; 11, *H. triangulata*; 12, *H. stamineata*; 13, *H. etes*; 14, *H. kurenzovi*.

tized. Segment 8 membranous or weakly sclerotized. Anterior apophysis varies in length, from $\frac{1}{2}$ to $\frac{1}{5}$ of posterior apophysis, often anterior apophysis missing (*taigana*, *serraria*, *serrataria*, *kurenzovi*). Ostium bursae ventrally with lamella antevaginalis bar-shaped (*postalbida*, *yunnanensis*, *incerta*, *hoenei*, *stamineata*, *eclinosi*) or shell-shaped (*triangulata*); dorsally with lamella postvaginalis forming large horn-like processes (*taigana*) or semi-round processes densely covered with minute spines (*serraria*, *serrataria*, *kurenzovi*). Ductus bursae varies in length, from very short (*serraria*, *serrataria*, *kurenzovi*) to long, wall with sclerites (*postalbida*, *yunnanensis*), sometimes largely expanded from the anterior to the antrum (*quadrifulta*). Corpus bursae varies in size and shape between species, ovular, membranous (*postalbida*, *incerta*, *dentifasciata*) or strongly sclerotized (*serraria*, *serrataria*, *kurenzovi*), occasionally with appendix bursae (*yunnanensis*), often wall with minute scobinations; signum usually absent, occasionally with one patch of scobinated signa (*taigana sounkeana*).

Distribution

The species of *Heterothera* are widely distributed in the Palearctic and Oriental regions, but they are especially abundant in the Oriental region: there are eight species in northern India and Nepal, six species in southwestern China (Tibet), two species in Taiwan, five species in northeastern Asia, one species in the western and eastern Palearctic and one species in the western Palearctic only. Some species are quite widely spread throughout the Palearctic region. For example, *H. serraria* is found from northern Europe to eastern Siberia, *H. taigana* from central Siberia to Kurile Islands and Japan, and *H. postalbida* from western China to the Korean Peninsula and Japan. On the other hand, many species are endemic to the Oriental region (e.g. the two Taiwanese species *H. incerta* and *sororcula*).

Remarks

The bipectinated male antenna was used as a character for *Viidaleppia* (Inoue 1986). However, cladistic analyses of the Cidariini (Choi 1997) and of *Thera* s.l. (Choi unpublished) indicate that the pectination of male antenna is not a synapomorphy of *Heterothera*, whereas the long pectination of the male antenna is a good diagnostic character for some species of *Heterothera* (e.g. *incerta*, *tephroptilus*, *mussooriensis*, *hoenei*).

The anellus lobes of the male genitalia in *Heterothera* are quite helpful to diagnose taxa, especially those from southwestern China. The lobes are usually digitiform or rounded in the apical part. However, two species, *H. eclinosi* and *yunnanensis*, possess great-

ly modified anellus lobes: they are apically sharply projected and medially triangular, expanded. Both species occur in southwestern China. Nevertheless, the wing pattern and the genitalia indicate that they are allied to *Heterothera* and especially, the characters such as the filiform male antenna and lamella postvaginalis of the female genitalia show an affinity to *H. postalbida*.

The presence of spines around the neck of aedeagus is recognized as a derived character for *Thera* (Viidalepp 1980, Choi 1997). However, this feature is also found in some species of *Heterothera* (e.g. *incerta*, *dentifasciata*, *hoenei*, and *yunnanensis*). Therefore, it seems to me that the character is a symplesiomorphy for *Thera* s.l.

Checklist of *Heterothera*

Heterothera Inoue, 1943

- H. postalbida* (Wileman, 1911)
- H. sororcula* (Bastelberger 1909)
- H. tephroptilus* (Fletcher, 1961) comb. n.
- H. mussooriensis* sp. n.
- H. undulata* (Warren, 1888) comb. n.
- H. hoenei* sp. n.
- H. incerta* (Inoue, 1986)
- H. quadrifulta* (Prout, 1938)
- H. obscurata* sp. n.
- H.entifasciata* (Hampson, 1895)
- H. distinctata* sp. n.
- H. yunnanensis* sp. n.
- H. eclinosi* sp. n.
- H. triangulata* sp. n.
- H. comitabilis* (Prout, 1923) comb. n.
- H. stamineata* sp. n.
- H. consimilis* (Warren, 1888)
- H. etes* (Prout, 1926) comb. n.
- H. taigana* (Djakonov, 1926)
- taigana taigana* (Djakonov, 1926)
- taigana sounkeana* (Marsumura, 1927)
- taigana ishibizukai* (Inoue, 1955) syn. n.
- H. serraria* (Lienig, 1846)
- H. serrataria* (Prout, 1914) comb. n.
- H. kurenzovi* Choi, Viidalepp & Vasjurin sp. n.
- H. firmata* (Hübner, 1822)

Thera Stephens, 1831

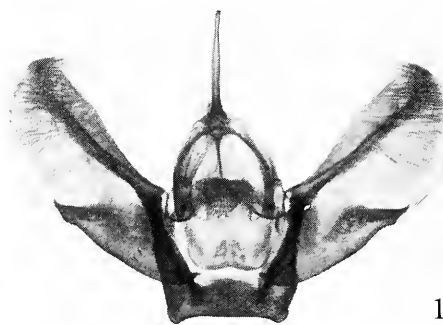
- T. cyphoschema* (Prout, 1926) incertae sedis
- atrinotata* Joannis, 1929 syn. n.
- atrinotata reducta* Joannis, 1929 syn. n.
- T. exangulata* (Warren 1909) incertae sedis

Pennithera Viidalepp, 1980

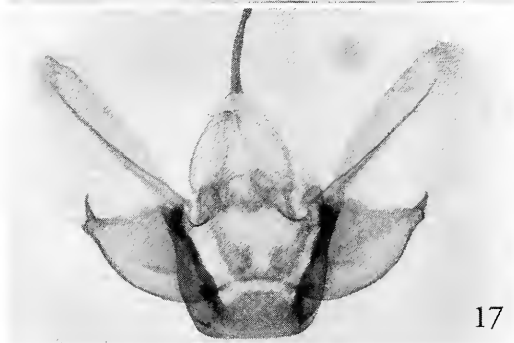
- P. distractata* (Sterneck, 1928) comb. n.



15



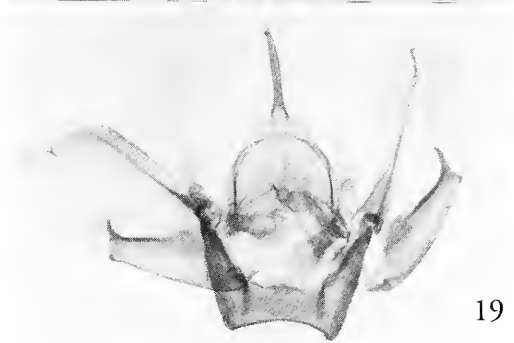
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18



19



20

Figs. 15-20. Genital capsule in the male genitalia of *Heterothera*. – 15, *H. tephroptilus*; 16, *H. undulata*; 17, *H. incerta*; 18, *H. boenei*; 19, *H. obscurata*; 20, *H. dentifasciata*.

Key to the species of *Heterothera* (males)

Two species, *H. triangulata* and *H. stamineata*, are not included, because they are only known from females. However, based on the wing pattern elements, *H. triangulata* is similar to *H. dentifasciata* and *H. stamineata* is similar to *H. comitabilis*.

1. Antenna of male bipectinate2
- Antenna of male filiform.....16
2. Pectinations of male antenna long.....3

- Pectinations of male antenna short.....12
- 3. Dorsum of the forewing with a long black horizontal streak.....4
- Dorsum of the forewing without a black horizontal streak6
- 4. Postmedial line of the forewing costally ample and round; costa of the valva nearly flat or distally expanded.....5
- Postmedial line of the forewing costally slightly invaginated; costa of the valva basally expanded.....*H. mussooriensis*

5. Costa of the valva nearly flat.....*H. tephroptilus*
- Costa of the valva distally widely expanded.....*H. etes*
6. Forewing ground colour blackish*H. consimilis*
- Forewing ground colour whitish or yellowish....7
7. Forewing ground colour whitish8
- Forewing ground colour yellowish10
8. Central fascia of the forewing medially reduced or broken9
- Central fascia of the forewing medially not reduced*H. serrataria*
9. Termen of the hindwing with a blackish waved subterminal line; occurring in Europe, Central and Eastern Siberia.....*H. serraria*
- Termen of the hindwing without a blackish waved subterminal line; occurring in the Russian Far East, Korea or Japan*H. kurenzovi*
10. Forewing with a distinct blackish discoidal dot ...
.....11
- Forewing with a discoidal dot united to the costal part of antemedial line.....*H. firmata*
11. Central fascia of the forewing medially and dorsally reduced; costa of the valva medially slightly expanded; ductus bursae relatively short, pleated in general*H. incerta*
- Central fascia of the forewing nearly even in width; costa of the valva medially triangular, expanded; ductus bursae slim, membranous.....*H. hoenei*
12. Postmedial line of the forewing costally strongly slanting13
- Postmedial line of the forewing costally relatively less slanting.....14
13. Central fascia of the forewing dorsally greatly reduced; interantennal fillet blackish.....*H. dentifasciata*
- Central fascia of the forewing nearly constant in width; interantennal fillet distinct with white scales.....*H. distinctata*
14. Central fascia nearly constant in width.....*H. taigana*
- Central fascia reduced at dorsum15
15. Antemedial line of the forewing medially sharply indented; anellus lobe digitiform; ductus bursae anterior to antrum greatly expanded*H. quadrifulta*
- Antemedial line of the forewing medially not indented; anellus lobe relatively thick; ductus bursae anterior to antrum not expanded.....*H. undulata*
16. Black horizontal streak or dot at dorsum between basal and antemedial line of forewing present ..17
- No blackish scales at dorsum between basal and antemedial line of forewing.....*H. obscurata*
17. Presence of a black horizontal streak at the dorsum of forewing18
- Presence of a black spot at the dorsum of forewing.....19
18. Postmedial line of the forewing costally slanting; lamella antevaginalis reduced to small sclerotized process; corpus bursae large*H. sororcula*
- Postmedial line of the forewing costally convex-shaped; lamella antevaginalis well developed with a pair of rod-shaped processes; corpus bursae relatively smaller.....*H. postalbida*
19. Central fascia dorsally reduced; anellus lobe apically sharply projected and dentate, medially triangularly projected; lamella postvaginalis with a pair of large rod-shaped processes.....*H. yunnanensis*
- Central fascia relatively even in width; anellus lobe apically sharply projected and bifid; lamella postvaginalis simple*H. eclinosis*

Heterothera postalbida (Wileman)
(fig. 1)

Cidaria postalbida Wileman, 1911: 325. Holotype ♂, JAPAN: Tokyo, Prov[ince]. Musashi, Honshu plains, 29.iv.1895, A.E. Wileman (BMNH) [examined].

Thera postalbida; Prout, 1941: 323.

Cidaria (Thera) postalbida problematica Bryk, 1948: 173. Holotype ♀, KOREA: Juwool (Shuotsu), 28.vi.1935, (SNHM) [examined]. [Synonymized by Inoue, 1977: 268].

Heterothera postalbida; Inoue, 1943: 12.

Diagnosis

This species is distinguished by the greyish forewing and whitish hindwing, blackish horizontal streak at dorsum, smooth postmedial line, and the medially reduced central fascia. The male genitalia show the well developed complex of juxta and transtilla, digitiform anellus lobe with an expanded and angled apical part, broad valva with two spinular sacculus processes and apically densely scobinated aedeagus. In the female genitalia, the bar-like sclerotized lamella antevaginalis and a bowl-shaped antrum are characteristic.

Redescription

Antenna of male filiform. Frons mixed with blackish brown and white, below projected. Labial palp long, 1.5 times to twice of eye diameter. Wingspan 25–34 mm. Forewing ash grey; basal line grey, waved; antemedial line smooth, dorsally greatly incurved; postmedial line smooth, waved, costally and medially bulged, subdorsally indented, dorsum projected; central fascia reduced at bottom, discoidal dot long, blackish; subterminal line whitish and undulating; apical streak blackish; dorsum with long black horizontal streak. Hindwing whitish, with grey discoidal dot; fringe blackish. Thorax greyish, dorsum of metathorax white with blackish tufts. Legs mixed with blackish brown and white, tarsal joints distinct and whitish.

Male genitalia. – Uncus weakly sclerotized, moderate, basally tapered. Tegumen dome-shaped, basally incurved, with long, sclerotized anal tube. Saccus broad, convex, sclerotized. Juxta and transtilla form a tube-like complex, sclerotized, anellus lobe basally and medially digitiform, apically expanded, triangular, with long hairs. Valva distally broad, round with long hairs; costa flat, sclerotized, sometimes distally expanded; sacculus triangular, sclerotized, two distal spinular projections. Aedeagus slender, distodorsally densely scobinated; vesica tubular, with several minute scobinated cornuti.

Female genitalia. – Papillae anales weakly sclerotized. Anterior apophysis $\frac{1}{3}$ length of posterior apophysis. Antrum developed, deep, bowl-like, lamella postvaginalis large bar-like sclerotized processes, lamella antevaginalis thin, round, sclerotized. Ductus bursae medially twisted, with sclerotized walls. Corpus bursae ovate, wall with very minute scobinations.

Distribution

Japan, Korea, Ussuri, SE China. Sterneck (1928) reported one female from Guanxian, Prov. Sichuan (Kwan-hsien).

Remarks

Inoue (1943) designated this species as the type of *Heterothera*. He incorrectly described the uncus of the male genitalia as absent.

Bryk (1948) proposed a new subspecies from Korea, *H. postalbida problematica*. However, Inoue (1977) synonymized the subspecies with the nominal species. By checking the type specimens and the genitalia, I confirm that subspecific division of the species is unwarranted.

Four species, *H. postalbida*, *sororcula*, *tephroptilus* and *mussooriensis*, are similar to each other in the black horizontal streak along the dorsum of forewing, wing ground colour and the genitalia. However, these four species can be divided into two groups based on the male antennal pectination and the geographic range, (*H. postalbida* & *sororcula*) and (*H. tephroptilus* & *mussooriensis*). Moreover, these species groups can be distinguished by the shape of the dorsal part of sacculus, waved versus straight, and the processes of the male genitalia, sharply pointed versus hooked.

Biology

The species is bivoltine (Wileman 1911) and in Japan the larva is found only on *Pinus densiflora* (Sato & Nakajima 1987).

Additional material examined. – KOREA: Kangwon Prov. Mt. Kumgang-san, 2♂, 26.v.1985, Dr. A. Vojnits & L. Zombori; same locality, 2♀, 17-19.ix.1980, Dr. L. Forro & Gy. Topal; Pyongyang City, Pyongyang No. 1042. Mt. Ry-

oungak-san, 1♀, 13.x.1987, Korsos & Ronkay; S. Hwanghae Prov., Haeju, Mt. Suyong-san, No. 1050, 1♀, 16.x.1987, Korsos & Ronkay (HNMH). – JAPAN: Tokyo, 1♀, 10.v.1893, 1♀, 3.vi.1895, A.E. Wileman (BMNH), 1♂, 1.v.1953, P. Savolainen; Karuizawa, 1 ex., 24.vi.1952, P. Savolainen; Naganohara, 1♀, 9.x.1969, J. Kaisila (ZMH). – CHINA: Wenchow (Prov. Chekiang), 1♀, 1913, C.T. Bowring; Foochow (Prov. Fukien), 1♂, April, 1885, Leech (BMNH).

Heterothera sororcula (Bastelberger)

Thera sororcula Bastelberger, 1909a: 34. Holotype ♂, TAIWAN: Arizan, Kagi-Distrikt 7-10000 Fuss. in Senckenberg Museum, Frankfurt [Colour transparency in BMNH, examined].

Dysstroma (Thera) sororcula, Bastelberger, 1909b: 172.

Thera sororcula, Prout, 1941: 323.

Heterothera sororcula, Inoue, 1992: 127.

Diagnosis

This species is very similar to *H. postalbida* in the wing shape and the genitalia. However, it differs from *H. postalbida* in the distinct central fascia, dark greyish termen, less slanting antemedial line and angled costal part of postmedial line. In the female genitalia the reduced lamella antevaginalis, strongly sclerotized ductus bursae and large corpus bursae are distinguishing features of *H. sororcula*.

Redescription

Antenna of male filiform. Frons covered with brown and white scales. Labial palp long. Wingspan 27-29 mm. Forewing greyish, basal line blackish, dentate; area between basal and antemedial line tinged with dark grey; antemedial line smooth, slanted; postmedial line smooth, blackish, costally slanted, medially bulged, submedially indented, dorsum slightly bulged; central fascia dark grey, with black discoidal line, dorsally reduced; termen dark greyish, sometimes whitish subterminal line appeared; apical streak blackish line; dorsum with black streak. Hindwing white tinged with grey, with small discoidal dot; fringe blackish. Thorax dark grey, dorsum of metathorax white with black tufts. Legs mixed with brown and white scales, tarsal joints white.

Male genitalia. – Uncus slender, medially expanded. Saccus broad, middle invaginated, anellus lobe digitiform, apical part not expanded, with long hairs. Valva medio- and distoventrally membranous; costa sclerotized, distally wider; sacculus triangular, sclerotized, one large and one minute distal processes. Aedeagus slender, distally scobinated; vesica tubular, cornuti small spines, arranged into two layers.

Female genitalia. – Antrum bowl-like, lamella antevaginalis bar-like, sclerotized processes, ventrally thin and thread-like. Ductus bursae strongly sclerotized and twisted. Corpus bursae large, globular, wall has minute scobinations.

Distribution

Taiwan.

Remarks

Bastelberger (1909a) noted that this species is similar to *H. consimilis* Warren and suggested it might be one subspecies of *consimilis*. However, he (1909b) placed this species in *Dysstroma* based on the shape of the male antennae. Prout (1941) noted its closeness to *H. postalbida*.

Material examined. – TAIWAN: Alishan (2200 m), Chiayi, 1 ♂ 1 ♀, IX.1964, Y.I.Chu; 1 ♂ 1 ♀, 9–11.vii.1964, H. Inoue; 1 ♂, 19–22.vi.1943, M. Owada; Nan-Tou-sien, 1 ♂ 1959, ex. H. Kezuka (BMNH); Tayuling (2600 m), Hualien Hsien, 1 ♂, 26.iii.1987, Y. Shibata; 4 ♂ 1 ♀, 1.iv.1984, A. Kawabe; 2 ♂ 2 ♀, 1.iv.1984, S. Sugi (BMNH); 1 ♀, 28–29.viii.1983; 1 ♂, 2–4.v.1984; 1 ♂ 1 ♀, 12–14.iii.1985, H. Yoshimoto (KY); Rantaizan, 7500 ft. 1 ♀, 9.v.1909; 1 ♂, 10.v.1909; 1 ♀, 15.v.1909, A. E. Wileman (BMNH).

***Heterothera tephroptilus* (Fletcher) comb. n.**

(figs. 2, 15, 27, 46)

T hera tephroptilus Fletcher, 1961: 170, figs. 10, 41, 50 & 51. Holotype ♂, NEPAL: Mustangbhot, 29°11' n. Br., 83°58' ö. L., Tagsa, 4300 m. 24.viii.[19]55, Leg. F. Lobbichler (ZSM) [examined].

Diagnosis

This species is similar to *H. postalbida* in wing shape, but differs in the long, bipectinate male antenna, blackish wing colour, the absence of the discoidal dot, and medially deeply indented antemedial line of forewing.

Redescription

Antenna of male bipectinate, with long pectinations. Frons mixed with brownish and white. Labial palp blackish, long. Wingspan 26–32 mm. Forewing blackish; basal line blackish; antemedial line costally greatly slanted, dorsally waving; postmedial line costally slanted, medially bulged; central fascia costally dark, discoidal dot absent, medially reduced; dorsum with black horizontal streak; apical streak black line. Hindwing blackish, with weak discoidal dot. Thorax dark grey, dorsum of metathorax white with black tufts.

Male genitalia. – Uncus long, medially bent. Tegumen triangular. Saccus sclerotized, flat at bottom. Juxta broad, sclerotized, anellus lobe short, round. Valva mid- and distoventrally expanded; costally flat, sclerotized; sacculus strongly sclerotized, triangular, with dorsal border undulated, one sclerotized distal spinular process. Aedeagus small, sclerotized surfaces, having a bundle of small spines ventro- and distodorsally, small round vesica with several spinular cornuti, arranged into a circle.

Female genitalia. – Anterior apophysis half length

of posterior apophysis. Antrum sclerotized, simple, relatively narrower. Ductus bursae broad, short, with a sclerotized wall. Corpus bursae large, subspherical, membranous.

Distribution

Nepal.

Remarks

The specimens from Gandaki (Nepal) are smaller (wingspan 26–28 mm) than the type specimen (wingspan 32 mm).

Additional material examined. – NEPAL: Paratypes 1 ♂, Mustangbhot, 29°11' n. Br., 83°58' ö. L., Tagsa, 3500 m, 12.viii.[19]55, Leg. F. Lobbichler; 1 ♀, same locality, 3800 m, 8.viii.[19]55 (BMNH); Mustangbhot, 29°11' n. Br., 83°58' ö. L., Tagsa, 4300 m, 1 ♀, 24.viii.[19]55, F. Lobbichler (ZSM); Gandaki above, Old Marpha 3450 m, 1 ♂ 1 ♀, 12.viii.1996, M. Fibiger (ZMH).

***Heterothera mussooriensis* sp. n.**

(figs. 3, 38, 39)

Type material. – Holotype ♂, N. INDIA: Mussoorie, 6000', Dehra Dun, U.P., 4.vii.1942 (AMNH). Paratype ♂, same locality, 10.vii.1944 (AMNH).

Diagnosis

This new species is very similar to *H. tephroptilus* in the wing pattern and the male genitalia, but it differs from *tephroptilus* in the slightly invaginated costal part of the postmedial line of forewing, the discoidal dot of hindwing, and the medially projected valval costa of the male genitalia.

Description

Antenna of male bipectinate, with long pectinations. Frons mixed with brown and ochreous scales. Labial palp moderate, slightly longer than eye diameter. Legs with yellowish tibial joints. Wingspan 27 mm. Forewing ground colour brownish; basal line waved, medially bulged; antemedial line costally blackish, discoidal dot united with costal part of line, medially deeply indented, dorsally waved; postmedial line costally slanted, medially bulged; central fascia costally blackish, medially and dorsally reduced; dorsum with black horizontal streak; apical streak black line; subterminal line very weak, waved. Hindwing pale brownish; discoidal dot small, blackish.

Male genitalia. – Uncus long, slender, medially bent. Tegumen small, dome-shaped. Juxta broad, sclerotized; anellus lobe long, digitiform, subapically expanded and fused with base of valva, apically long hairs present. Saccus sclerotized, both edges slightly projected. Ventral part of valva medially invaginated, distally largely expanded; costa sclerotized, medially

projected; sacculus triangular, sclerotized, dorsal border waved, one distal spinular process. Aedeagus cylindrical, distally scobinated; vesica small sac-like; cornuti two bundles of small spines.

Female genitalia. – Unknown.

Distribution

N. India.

Etymology

The specific name refers to the type locality, Mussoorie, Northern India.

Heterothera undulata (Warren) comb. n.
(figs. 4, 16, 28)

Ypsitpetes undulata Warren, 1888: 326. Lectotype ♂, here designated "N. INDIA: Thundiani, 29.viii.[18]86." (BMNH). *Cidaria* (*Thera*) *undulata*; Prout, 1938: 111. *Thera undulata*; Prout, 1941: 323.

Diagnosis

H. undulata is identified by the blackish wings, double vertical ante- and postmedial lines, and the costally smooth and waving postmedial line of forewing. The species is similar to *H. boenei*, but it can be distinguished from that by the blackish ground colour of wings and medially less projected costa, angled edges of saccus, and relatively thin sacculus of the male genitalia.

Redescription

Antenna of male bipectinate, pectinations as short as diameter of shaft. Frons mixed with brownish and white. Labial palp as long as eye diameter. Wingspan 24–33 mm. Forewing dark grey; subbasal line present, blackish, basal line blackish, slanted, costally projected; antemedial line consisted of double vertical lines, slanted, medially slightly indented; postmedial line forming two vertical lines, smooth, medially bulged; central fascia blackish, medially reduced, bottom distinct with blackish scales; termen blackish, subterminal line whitish, waved; apical streak black line. Hindwing dark brownish, with blackish postmedial line. Thorax with blackish tufts.

Male genitalia. – Uncus long and slender. Tegumen dome-shaped. Saccus strongly sclerotized, both edges projected. Anellus lobe short, relatively thick in width, with apically long hairs. Ventral part of valva medially slightly invaginated; costa medially slightly expanded; sacculus strongly sclerotized, triangular, with distally two processes. Aedeagus basally tapered, sclerotized, distally scobinated, vesica with three bundles of cornuti.

Female genitalia. – Anterior apophysis $\frac{1}{3}$ length of posterior apophysis. Antrum broad; lamella antevagi-

nalis a pair of round projections, densely covered with minute scobinations. Ductus bursae twisted, sclerotized. Corpus bursae ovate.

Distribution

India, Nepal.

Remarks

Hampson (1895) listed the species under the character "Antennae of male serrate and with fascicles of cilia". Prout (1938) noted that *H. undulata* is similar to *Chloroclysta siterata* Hufnagel or *Hydriomena*, but differs in its antennal pectinations. Based on this, he put the species under *Thera*.

Additional material examined. – N. INDIA: Paralectotypes 2♂ 1♀, Thundiani, 6.ix.[18]86, (BMNH). – NEPAL: Gandaki above, Old Marpha, 3450m, 1♂ 1♀, 12.viii.1996, M. Fibiger (MF).

Heterothera boenei sp. n.
(figs. 5, 18, 29, 47)

Type material. – Holotype ♂, CHINA: Lijiang (Li-Kiang), Province Nord-Yunnan, 27.viii.1935, H. Höne (ZFMK). Paratypes 2♂, same locality, 27.vii.1935, 16.viii.1935, H. Höne; 1♀, Kangding (Tatsien-Lou), Prov. Sichuan, 18.viii.1898, Chasseurs indigènes (ZFMK).

Diagnosis

H. boenei is similar to *H. undulata* in the wing pattern elements, but differs from the latter in the strongly bipectinate male antenna, ochreous ground colour of forewing, and whitish hindwing. In the male genitalia, the species is characteristic by the medially triangular process of costa, more or less round saccus, and waving dorsal border of the sacculus and its stellate process.

Description

Antenna of male bipectinate, with long pectinations. Frons smooth, covered with white and blackish scales. Labial palp ochreous, moderate about as long as eye diameter, sometimes double of eye diameter. Wingspan 24–29 mm. Forewing ground colour ochreous; basal part whitish, basal line relatively thicker, blackish, slanted, bordered with white thin vertical line; area between basal and antemedial line with blackish vertical bar-shaped band; antemedial line blackish, medially indented; postmedial line costally slightly curved, medially bulged; central fascia whitish, sometimes tinged with blackish, discoidal dot large, blackish, dorsally reduced; subterminal line blackish, waved; apical streak blackish; fringe blackish. Hindwing whitish, with small blackish discoidal

dor; postmedial line blackish; fringe lined with blackish. Metathorax whitish, with black tufts.

Male genitalia. – Uncus moderate, medially bent. Tegumen triangular. Saccus shallow, flat at bottom, often midventrally slightly invaginated. Juxta sclerotized, invaginated at bottom. Anellus lobe short, digitiform. Valva distoventrally membranous, expanded; costa sclerotized, medially triangular projection; sacculus relatively small, with distally stellate process. Aedeagus slender, sclerotized, medially bent; small spinular cornuti present around neck of aedeagus.

Female genitalia. – Anterior apophysis $\frac{1}{4}$ length of posterior apophysis. Lamella antevaginalis plate-like, sclerotized processes, densely covered with minute spines. Ductus bursae thin, long. Corpus bursae ovate.

Etymology

The specific name is given to honour H. Hōne, who dedicated his whole life to collecting and studying Chinese Lepidoptera.

Distribution

S.W. China.

***Heterothera incerta* (Inoue)**

(figs. 17, 30)

Viidaleppia incerta Inoue, 1986: 234, figs 25D, 26. Holotype ♂, TAIWAN: Nengkaoshan, ca. 2800 m, Nantou Hsien, 20.V-2.VI.1966, Ching-Shong Yu (BMNH) [examined].
Heterothera incerta; Choi, 1997: 311.

Diagnosis

H. incerta is identified by the bipectinate male antenna, paler forewing, medially indented antemedial line, the angled costal part of postmedial line, and the distinct dorsum of central fascia and one patch of spinular processes at the distal part of aedeagus. It is similar to *quadrifulta* in the wing pattern, but *incerta* is separated from the latter by having the blackish scales at the bottom of the central fascia of forewing, the waving dorsal border of sacculus, and the relatively short and distally pleated ductus bursae.

Redescription

Antenna of male bipectinate, with long pectinations, basal and distal parts ciliate. Frons mixed with brownish black and white, below projected. Labial palp long, nearly double of eye diameter. Wingspan 26–27 mm. Forewing greyish or dark greyish; sub-basal, basal lines blackish; area between basal and antemedial lines with reddish brown band; antemedial line costally slanted, medially indented, below slightly dentate; postmedial line costally slightly angled, slanted, medially bulged, dorsally waved; central fascia dark greyish, dorsally reduced, blackish scales at bottom, discoidal dot blackish; termen reddish

brown with whitish scalloped subterminal line; apical streak black line. Hindwing whitish with black discoidal dot; termen greyish with black fringe. Thorax greyish, dorsum of metathorax white with black tufts. Legs mixed with white and brownish black, tarsal joints whitish.

Male genitalia. – Uncus slender, sclerotized, bent. Tegumen dome-shaped. Saccus flar at bottom, sclerotized. Anellus lobe small, nipple-shaped. Ventral part of valva medially expanded; costa medially expanded; sacculus triangular, dorsal border slightly waved, with one spinular process. Aedeagus cylindrical, slightly tapered, distoventrally scobinated and distodorsally a bundle of large spinular processes present; vesica without cornutus.

Female genitalia. – Anterior apophysis $\frac{1}{3}$ length of posterior apophysis. Lamella antevaginalis a pair of scobinated large lobes, ventrally semi-round plate structure. Ductus bursae short, distally pleated. Corpus bursae ovate, wall with minute scobinations.

Distribution

Taiwan.

Remarks

Inoue (1986) noted that this species was similar to *Dysstroma citratum* (Denis & Schiffermüller) [incorrect authorship, Linnaeus] on the basis of wing shape, colour and maculation. He also noted that this species was similar to *quadrifulta* in the male genitalia.

Material examined. – TAIWAN: Mt. Yu Shan (3528 m), Paiyunshanchuang, Kaohsiung Hsien, 1♂ 1♀, 2-3.viii.1985, M. Nishizawa (KY); Hohuanshan, 3100m, Nantou Hsien, 1♂ 1♀, 5.viii.1987, A. Kawabe, Coll. Inoue; Nantou Hsien, Formosa, 1♀, 1968, ex. H. Kezula, Coll. Inoue (BMNH).

***Heterothera quadrifulta* (Prout)**

(fig. 6)

Cidaria (*Thera*) *quadrifulta* Prout, 1938: 114. Lectotype ♂, here designated "JAPAN: Shinano, 2.viii.1911, coll[ection] Wileman" (BMNH).

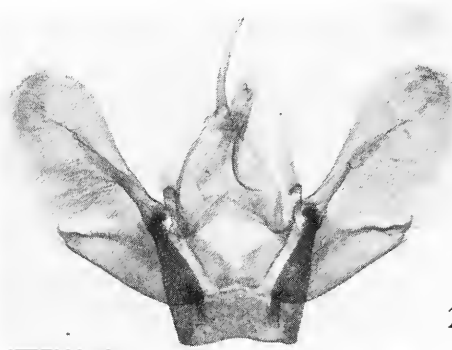
Asaphodes quadrifulta; Viidalepp, 1980: 64.

Viidaleppia quadrifulta; Inoue, 1982: 283.

Heterothera quadrifulta; Choi, 1997: 311.

Diagnosis

The wings of *quadrifulta* have whitish ground colour with shades of black, a waving antemedial line at the costal part, blackish discoidal dot, white scalloped subterminal line and basally blackish tinged hindwing. This species is similar to *H. incerta*, but differs in the whitish ground colour of forewing and short pectinations of male antenna. Distinguished from *H. incerta* by the middorsal expansion of the costa in the male genitalia and the distally largely expanded ductus bursae of the female genitalia.



21



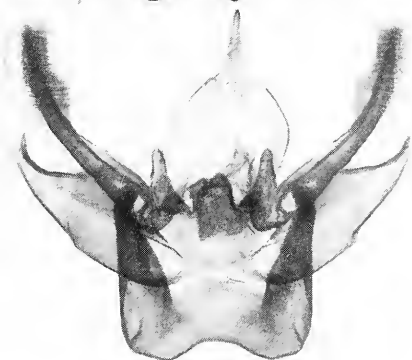
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Figs. 21-26. Genital capsule in the male genitalia of *Heterothera*. – 21, *H. distinctata*; 22, *H. yunnanensis*; 23, *H. eclinosis*; 24, *H. firmata*; 25, *H. serrataria*; 26, *H. kurenzovi*.

Redescription

Antenna of male bipectinate, with short pectinations, about same width as the shaft. Wingspan 31 mm. Forewing ground colour whitish; basal part dark grey, basal line blackish, slightly dentate; area between basal and antemedial lines with dark grey band; antemedial line costally extended inward, medially indented, dorsally slightly extended inward; postmedial line costally slanted, medially projected, below waved; central fascia greyish, with black discoidal dot, medi-

ally reduced, bottom distinct with blackish scales; subterminal line costally blackish, medially whitish, undulating; termen dark grey. Hindwing whitish, termen blackish, with black discoidal dot. Thorax mixed with brownish and white scales with tufts.

Male genitalia. – Uncus long, sclerotized, basally tapered. Tegumen dome-shaped. Anellus lobe small, nipple-shaped. Ventral part of valva medially slightly invaginated; costa sclerotized, middorsally expanded; sacculus triangular, dorsal border nearly straight, with

one large distal process. Aedeagus distally scobinated; vesica with two bundles of cornuti.

Female genitalia. – Anterior apophysis $\frac{1}{3}$ length of posterior apophysis. Lamella antevaginalis tongue-shaped with a pair of round patch and densely scobinated. Ductus bursae long, greatly expanded at distal part, wall with rows of spines and sclerites. Corpus bursae membranous, ovate, signum absent.

Distribution

Korea, Japan.

Remarks

Prout (1938) described the species from two males from Shinano, Japan. He noted that the species is similar to *Pennithera comis* Butler and *Heterothera taigana sounkeana* Matsumura, but differs from *P. comis* in the less distinct dorsal dot between basal and antemedial line of forewing. Inoue (1982) designated this species as type species for *Viidaleppia*.

Additional material examined. – JAPAN: Ontake, Gifu-ken. 1 ♂, 12-15.viii.1936, coll. Wileman; Kobushi, Saitama, 1 ♂, 4.viii.1953, T. Haruta (BMNH); Mt. Norikuradake, 2600m, Azumi-mura, Nagano, 1 ♂, 6.viii.1988, Y. Kishida; same locality, 1 ♀, 17.viii.1988, K. Yazaki; Odarumi-toge, Yamanashi, 1 ♂ 1 ♀, 29.vii.1990, K. Yazaki (KY). – KOREA: Prov. Ryang-gang, Chann-Pay Plateau, Sam-zi-yan, 1700m, No. 285, 1 ♂, 24.vii.1975, J. Papp & A. Vojnits (HNHM).

Heterothera obscurata sp. n.

(figs. 7, 19, 31)

Type material. – Holotype ♂, w. NEPAL: Karnali, Mugu Dist[ri]ct., Rara lake 2,990 m, 25- 26.ix.1981, M. Owada, Coll. K. Yazaki (ZFMK).

Diagnosis

This species is quite similar to *incerta* in wing pattern elements but can be separated from it by the filiform male antenna without pectinations, its greyish wings and by the male genitalia which have a relatively long anellus lobe, a distally expanded costa, a relatively thin sacculus, and scattered spinular cornuti of the vesica.

Description

Antenna of male filiform. Frons covered with white and blackish scales. Labial palp long, about 1.5 times of eye diameter. Metathorax has blackish tufts. Wingspan 27 mm in male. Forewing ground colour greyish; basal line dentate; antemedial line medially sharply indented; postmedial line costally slanted, wavy, medially bulged; central fascia greyish, with black discoidal dot, blackish scales present at bottom, medially reduced; termen brownish, with weak blackish subterminal line. Hindwing greyish, with blackish postmedial line.

Male genitalia. – Uncus long, sclerotized, medially bent. Tegumen bell-shaped, sclerotized. Saccus sclerotized, medially broadly invaginated. Juxta sclerotized, anellus lobe long, digitiform with hairs on top. Costa of valva strongly sclerotized, distally wider; sacculus triangular, sclerotized, distally two processes with one large and one small. Aedeagus short, cylindrical, distally tapered and scobinated; vesica small, with several large and small spinular cornuti.

Female genitalia. – Unknown.

Etymology

The specific name refers to the indistinct pattern elements of forewing.

Distribution

Nepal.

Heterothera dentifasciata (Hampson)

(figs. 20, 32)

Larentia dentifasciata Hampson, 1895: 379. Lectotype ♂, here designated "PAKISTAN: Murree, 1884, Harford coll[ection]." (BMNH).

Cidaria (Thera) dentifascia; Prout, 1914: 219. [Incorrect spelling].

Thera dentifasciata; Prout, 1941: 324.

Viidaleppia dentifasciata; Yazaki, 1994.

Heterothera dentifasciata; Choi, 1997: 311.

Diagnosis

H. dentifasciata is easily identified by the blackish and greatly slanting costal part of postmedial line and large blackish discoidal dot of forewing. The male genitalia of *dentifasciata* are similar to those of *H. obscurata*, but the processes of sacculus and the cornuti of the vesica are different.

Redescription

Antenna of male bipectinate, with short pectination as long as shaft. Frons mixed with brownish black and white scales. Labial palp long about twice of eye diameter. Wingspan 29-34 mm. Forewing reddish brown or greyish; basal line blackish; antemedial line weakly slanted, medially indented; postmedial line costally strongly slanted, medially bulged; central fascia blackish, medially broader and dorsally reduced, with black discoidal dot; subterminal line blackish and undulating; apical streak blackish line. Hindwing whitish, basal slightly blackish, with black discoidal dot and postmedial line, fringe black. Metathorax middorsally white with black tufts.

Male genitalia. – Uncus long, slender, sclerotized, basally tapered. Tegumen dome-shaped. Saccus sclerotized, medially concave-shaped. Anellus lobe small, digitiform. Ventral part of valva distally wider, with long hairs; costa sclerotized, distally expanded; saccu-



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lus triangular, with a distal spinular process. Aedeagus sclerotized, basally tapered, distally scobinated; vesica with two bundles of cornuti.

Female genitalia. – Anterior apophysis half length of posterior apophysis. Antrum broad, strongly sclerotized. Ductus bursae twisted, relatively short, thick. Corpus bursae small, ovate.

Distribution

India, Pakistan, Nepal.

Remarks

Hampson (1895) listed the species with *Pennithera comis* under the character “Antennae of the male with two pairs of short cilia-bearing processes from each joint”. Prout (1938) noted that the species is similar to *consimilis* in the colour of central fascia and it is also similar to *Thera exangulata* Warren, but differs from *T. exangulata* by the less waved basal line of forewing, pale hindwing and the angled postmedial line of hindwing.

Additional material examined. – NEPAL: Central N. Ganesh Himal. Nesim 2200m, 2♂, 23.x.1995, M. Fibiger; Central N. Ganesh Himal. Godlang 2560 m, 1♂ 2♀, 13.x.1995, M. Fibiger; Sagarmatha N.P., 27°49'N 86°44'E, Kyang Juma, 3600 m, 1♀, 19.v.1996, A. Albrecht, O. Bistrom, K. Mikkola & A. Wikberg; Sagarmatha N.P., 27°48'N 86°44'E, Syanboche, 3800 m, 2♀, 22.v.1996, A. Albrecht, O. Bistrom, K. Mikkola & A. Wikberg (ZMH); W. Nepal, Karnali, Mugu Dist. Rara Lake, 2990 m, 1♂, 25-26.ix.1981, M. Owada (KY); Bagmati Rasuwa, Yuli Karka, 3375m, 1♀, 12-13.v.1993, T. Haruta (KY).

Heterothera distinctata sp. n.

(figs. 8, 21, 33)

Type material. – Holotype ♂, CHINA: Lijiang (Li-Kiang), Province Nord-Yunnan, 21.iv.1935, H. Höne (ZFMK).

Diagnosis

The new species is identified by the short pectinations of the male antenna, whitish interantennal fillet, ochreous forewing, whitish hindwing, and the strongly slanted costal part of the postmedial line of forewing. This new species is very similar to *dentifasciata* in the wing shape and the male genitalia, but it can be distinguished from *dentifasciata* by the whitish interantennal fillet and the even width of central fascia, which is not reduced at the middle and dorsum of fascia.

Description

Antenna of male bipectinate, with short pectinations. Interantennal fillet and frons white. Labial palp moderate. Legs dark ochreous, with whitish tibial joints. Metathorax with whitish hairs on middorsum, with black tufts. Wingspan 29 mm in male. Forewing ground colour yellow ochreous; basal line blackish, nearly vertical; area between basal and antemedial line tinged with blackish scales; antemedial line blackish, medially indented; postmedial line costally slanted, medially bulged; central fascia ochreous, discoidal dot one large blackish, dorsally distinct with blackish scales; subterminal line blackish and undulating; apical streak blackish line. Hindwing whitish, with black discoidal dot; postmedial line blackish, medially bulged.

Male genitalia. – Uncus sclerotized, medially bent, moderate in length, as long as height of tegumen. Tegumen triangular. Saccus sclerotized, broad and flat at bottom. Juxta sclerotized. Anellus lobe small, digitiform, with hairs on top. Costa sclerotized, distally largely expanded; sacculus triangular, sclerotized, distally with a hooked process. Aedeagus distally tapered, sclerotized; vesica small, sac-like, cornuti mixed with small and medium spinular processes, located around neck and middle of vesica.

Female genitalia. – Unknown.

Etymology

The specific name refers to the diagnostic wing pattern elements of the forewing.

Distribution

S.W. China.

Heterothera yunnanensis sp. n.

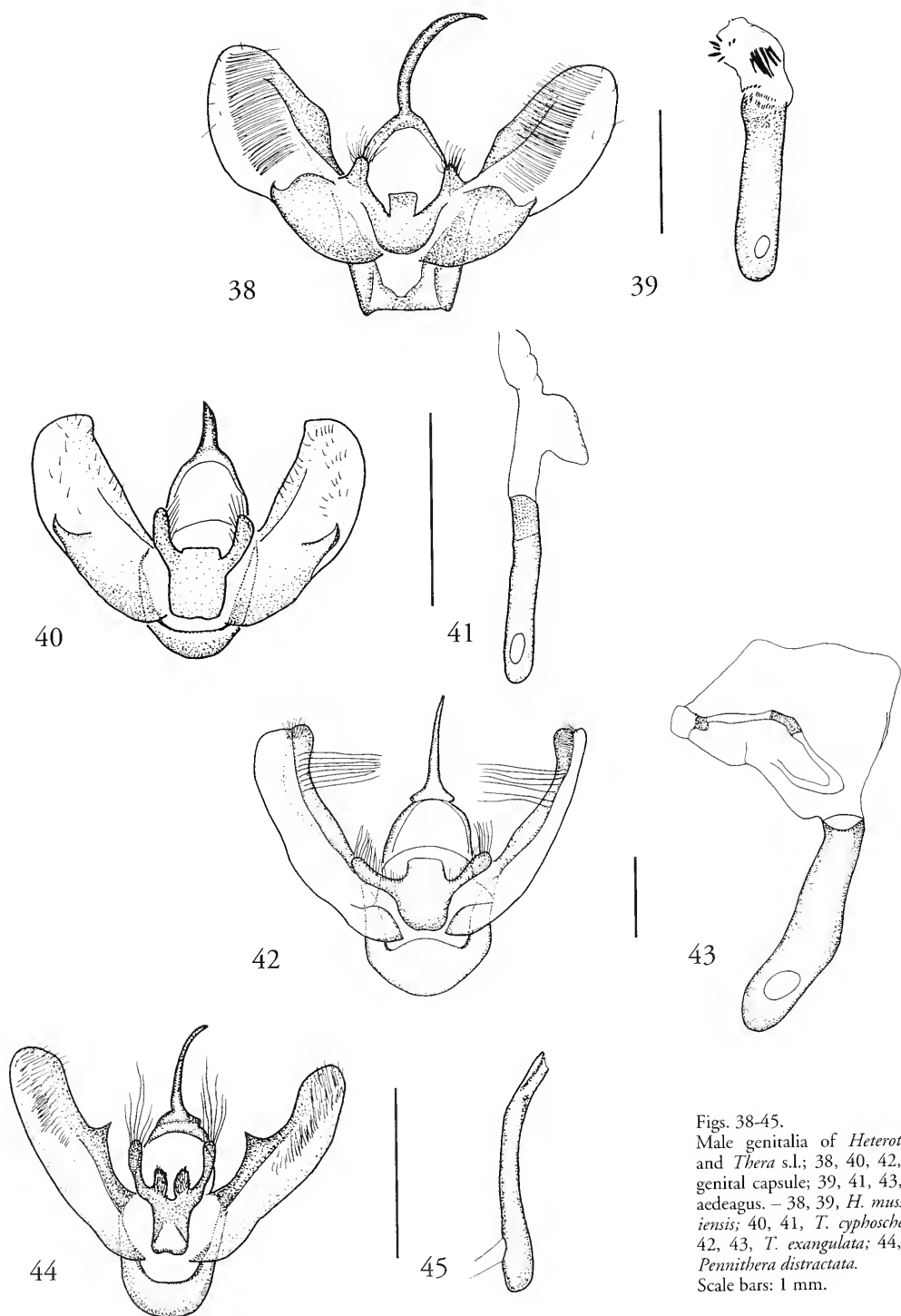
(figs. 9, 22, 34, 48)

Type material. – Holotype ♂, CHINA: Lijiang (Li-Kiang), Province Nord-Yunnan. 27.vi.1935, H. Höne (ZFMK); Paratype ♀, CHINA: A-tun-tse (Nord-Yunnan), Talsohle ca. 3000m, 4.vii.1937, H. Höne (ZFMK).

Diagnosis

H. yunnanensis is distinguished by the blackish and greatly reduced central fascia at the middle and dorsal parts and the black horizontal streak along the dorsum of basal part and central fascia. The anellus lobes of the male genitalia, apically sharp and pointed, medially triangular and expanded, are characteristic. This new species is quite similar to *H. dentifasciata* in wing shape,

Figs. 27-37. Aedeagus with everted vesica of *Heterothera*. – 27, *H. tephroptilus*; 28, *H. undulata*; 29, *H. boenei*; 30, *H. incerta*; 31, *H. obscurata*; 32, *H. dentifasciata*; 33, *H. distinctata*; 34, *H. yunnanensis*; 35, *H. eclinosia*; 36, *H. serrataria*; 37, *H. kurenzovi*.



Figs. 38-45.
Male genitalia of *Heterothera*
and *Thera* s.l.: 38, 40, 42, 44,
genital capsule; 39, 41, 43, 45,
aedeagus. – 38, 39, *H. mussoor-*
iensis; 40, 41, *T. cyphoschema*;
42, 43, *T. exangulata*; 44, 45,
Pennithera distractata.
Scale bars: 1 mm.

but it can be distinguished from *H. dentifasciata* by the filiform male antenna, black streak at the dorsum of forewing, the anellus lobe and the cornuti of the vesica. The lamella antevaginalis of the female genitalia, with a rod-shaped process, is similar to *H. postalbida*.

Description

Antenna of male filiform. Frons mixed with white and blackish brown scales. Labial palp moderate in length. Legs mixed with white and blackish brown. Metathorax blackish, with black tufts. Wingspan 32 mm in male, 36 mm in female. Forewing ground colour greyish; basal line blackish, consisting of double vertical lines, dentate; antemedial line medially slightly indented, slanting from costa to dorsum; postmedial line costally smooth, slanted, medially bulged, dorsally waving; central fascia blackish, medially and dorsally greatly reduced, dorsally blackish; border of costal part of postmedial line lined with whitish; subterminal line blackish and undulating; termen greyish; apical streak black line; dorsum between basal and antemedial lines with black bar. Hindwing whitish; postmedial line blackish, double vertical lines; fringe dotted with black.

Male genitalia. – Uncus slender, long, about 1.5 times the height of tegumen. Tegumen bell-shaped. Saccus medially invaginated. Juxta round at bottom, sclerotized. Anellus lobe medially triangular, sclerotized, apically sharp, slightly bifurcated. Costa sclerotized, medially wider; sacculus triangular, sclerotized, distally spine-like process. Aedeagus slender, sclerotized; cornuti comprised of three bundles of spinular processes at ventro- and dorsobasal part and middle part of vesica.

Female genitalia. – Papillae anales weakly sclerotized. 8th segment weakly sclerotized. Lamella antevaginalis laterally a pair of large spinular spines, ventrally a pair of ring-like sclerotized processes with densely covered small spines. Ductus bursae short, with sclerotized wall. Corpus bursae large with one large appendix bursae.

Etymology

The specific name refers to the type locality, Yunnan.

Distribution

S.W. China.

Heterothera eclinosis sp. n.

(figs. 10, 23, 35, 49)

Type material. – Holotype ♂, CHINA: Taibaishan (Tapaishan im Tsinling), Sued-Shensi, 30.vi.1935, L. (1700m), H. Höne (ZFMK); Paratype ♀, same local-

ty, 16.v.1936, H. Höne (ZFMK).

Diagnosis

H. eclinosis is characterized by the slanted and dorsally blackish central fascia of forewing. It is similar to *H. yunnanensis* in the wing pattern and the male genitalia, but it can be distinguished by its smaller size, ochreous ground colour of wings and relatively constant width of central fascia and the medially not expanded anellus lobe of the male genitalia and the general structure of the female genitalia.

Description

Antenna of male filiform. Frons with white and blackish scales. Labial palp long, about 1.5 times the eye diameter. Legs dorsally blackish, with whitish tibial joints. Thorax dorsally white, metathorax with blackish tufts. Wingspan 27 mm in male, 30 mm in female. Forewing ground colour ochreous; basal area dark ochreous, basal line waving; antemedial line greatly slanted, medially indented; postmedial line medially bulged, slightly waving; central fascia dark ochreous, dorsally slightly reduced; termen blackish, subterminal line whitish, undulating; apical streak blackish line; dorsum with black dot. Hindwing white, with small discoidal dot; postmedial line light blackish, medially bulged; fringe black.

Male genitalia. – Uncus strongly sclerotized, long, about twice of height of tegumen. Tegumen triangular. Saccus sclerotized, medially invaginated. Juxta sclerotized. Anellus lobe sclerotized, long, rod-shaped, medially elbowed, apically bifurcated. Costa sclerotized, distally wider; sacculus triangular, sclerotized, with a distal spinular process. Aedeagus slender, sclerotized; cornuti small spinular process, present on basal and middle parts of vesica.

Female genitalia. – Anterior apophysis $\frac{1}{3}$ length of posterior apophysis. Lamella antevaginalis a pair of triangular plates which are densely covered with small spines. Antrum thin, sclerotized. Ductus bursae relatively short, sclerotized. Corpus bursae with ovate appendix bursae, without signum, wall has minute scobinations.

Etymology

The specific name refers to the sloping central fascia of the forewing.

Distribution

S.W. China.

Additional material examined. – CHINA: Taibaishan (Tapaishan im Tsinling), Sued-Shensi, 1 ♂, 2.vii.1935, 1 ♀ 23.vi.1935, H. Höne. (BMNH).

Heterothera triangulata sp. n.
(figs. 11, 50)

Type material. – Holotype ♀, CHINA: Lijiang (Likiang), Province Nord-Yunnan, 25.ix.1935, H. Höne (ZFMK).

Diagnosis

This species is very similar to *H. dentifasciata* in the central fascia. However, it can be distinguished from the latter by its smaller wings, less indented antemedial line, and the lamella antevaginalis and ductus bursae of the female genitalia.

Description

Antenna of female filiform. Frons mixed with white and blackish scales, with blackish projecting hairs below. Labial palp long, double the eye diameter. Legs mixed with white and blackish scales, and whitish tibial joints. Metathorax whitish at middorsum, with blackish tufts. Wingspan 27 mm in female. Forewing ground colour ochreous; basal part whitish, basal line relatively thicker, blackish; antemedial line smooth, medially slightly indented; postmedial line costally strongly slanted, medially bulged; central fascia tinged with blackish scales, with large discoidal dot, medially reduced, dorsally distinct and blackish; subterminal line weak, whitish vertical line; apical streak blackish line. Hindwing whitish, with small black discoidal dot; blackish postmedial line, medially bulged; termen blackish.

Male genitalia. – Unknown.

Female genitalia. – 8th segment long, with weakly sclerotized surface. Lamella antevaginalis shell-like processes. Antrum thin, sclerotized. Ductus bursae relatively thin, long. Corpus bursae ovate, without signum.

Etymology

The specific name refers to the triangular central fascia of forewing.

Distribution

S.W. China.

Heterothera comitabilis (Prout) comb. n.

Larentia comis Hampson, 1895: 379 (in part), nec Butler.
Thera comitabilis Prout, 1923: 198. Holotype ♂, N. INDIA: Sikkim, Jongri, 13000 ft., 1887, ex. coll. Elwes (BMNH) [examined].

Diagnosis

The waved costal part of postmedial line, the relatively thicker and the blackish subterminal line of forewing and blackish hindwing are characteristic features of *comitabilis*. The species is similar to *H. stamineata*, but differs in the costally toothed postmedi-

al line of forewing and blackish ground colour of hindwing.

Redescription

Antenna of male bipectinate with short pectinations. Frons covered with dark ochreous and white scales. Labial palp long, double of eye diameter. Interantennal fillet whitish. Wingspan 30 mm. Forewing dark ochreous; basal part blackish, basal line distinct with whitish; area between basal and antemedial line with blackish bar; antemedial line medially indented; postmedial line costally dentate, slightly tinged with white, medially bulged; central fascia blackish, with black discoidal dot; subterminal line thick, blackish, undulating. Hindwing pale blackish; discoidal dot blackish; postmedial line paler; fringe black.

Male genitalia and female genitalia not examined (see remarks below).

Distribution

N. India.

Remarks

Prout (1923: 198) noted that the species is similar to *Pennithera comis* Butler in the antennal structure, but differs in the short branches of antenna. He also noted that the species is similar to *Electrophaes corylata* in the darkish coloration.

The genitalia of *comitabilis* are not examined because the types listed were lacking their abdomens. The placement of the species in *Heterothera* is based on the shape of wing pattern elements which is similar to *H. stamineata*.

Additional material examined. – Paratype ♀, N. INDIA. Sikkim, Tonglo, July 1886, Collectio[n] H.J. Elwes. (BMNH).

Heterothera stamineata sp. n. (figs. 12, 51)

Type material. – Holotype ♀, CHINA: Lijiang (Likiang), Province Nord-Yunnan, 4.vii.1935, H. Höne (ZFMK); Paratype ♀, same locality, O, 17.vi.1935, H. Höne (ZFMK).

Diagnosis

The new species is similar to *comitabilis* in the shape of the wings, but differs in the whitish ground colour of the hindwing.

Description

Antenna of female filiform. Frons covered with white and blackish scales. Labial palp length twice the eye diameter. Metathorax with blackish tufts. Wingspan 30–31 mm in female. Forewing ground colour brownish; basal part dark brownish, basal line den-

tate; antemedial line bordered with whitish, costally slanted, medially and dorsally nearly vertical; post-medial line costally bordered with whitish line, medially bulged; central fascia brownish, discoidal dot black, bottom blackish; subterminal line blackish, undulating; fringe dotted with blackish. Hindwing whitish, with black discoidal dot; postmedial line blackish; fringe lined with black.

Male genitalia. – Unknown.

Female genitalia. – 8th segment weakly sclerotized. Anterior apophysis $\frac{1}{4}$ length of posterior apophysis. Lamella antevaginalis a plate-like process, densely covered with small spinular spines, ventrally with semi-circular sclerotized plate. Ductus bursae relatively short, thin. Corpus bursae ovate, without signum.

Etymology

The specific name refers to the shape of the thread-like central fascia.

Distribution

S.W. China.

***Heterothera consimilis* (Warren)**

(fig. 52)

Thera consimilis Warren, 1888: 326. Holotype ♂, N. INDIA: Thundiani, 9.x.[18]86, Genitalia slide No. 3986. (BMNH) [examined]

Larentia consimilis; Hampson 1895: 380.

Heterothera consimilis; Choi 1997: 311.

Diagnosis

H. consimilis is easily identified by the wavy central fascia and dentate basal line of the forewing. In the female genitalia the thick and sclerotized ductus bursae is characteristic. This species is similar to *H. etes* in wing pattern, but differs in the blackish ground colour of wings.

Redescription

Antenna of male bipectinate, with long pectinations, tip and base filiform. Frons mixed with brownish and white scales. Labial palp long, twice diameter of eye. Thorax mixed with brownish and white scales, with tufts. Wingspan 24–29 mm. Forewing ground colour dark greyish or blackish; veins of basal part on blackish streak; subbasal line blackish, round; basal line black, dentate; area between basal and antemedial line with weak blackish band; antemedial line costally slanted, medially and dorsally waved; post-medial line costally straight, often bent, slanting, medially bulged, below waving, dorsally bulged; central fascia dark grey, with black discoidal line, sometimes medially and dorsally reduced; dorsum with large reddish dot; termen dark greyish with white undulating subterminal line; apical streak a black line. Hind-

wing whitish, termen dark greyish, with small black discoidal dot.

Male genitalia. – Uncus long, sclerotized, and slightly bent in middle. Tegumen triangular. Saccus flar at bottom and sclerotized. Anellus lobe small, digitiform. Ventral part of valva distally slightly expanded; costa sclerotized, medially very wider; sacculus triangular, dorsal border waved, with one distal large sclerotized spine. Aedeagus distally scobinated, with round vesica and cornuti in two bundles.

Female genitalia. – Anterior apophysis $\frac{1}{3}$ length of posterior apophysis. Antrum simple, unmodified. Ductus bursae thick, wall sclerotized. Corpus bursae ovate, small.

Distribution

India, Nepal, Afghanistan.

Remarks

Warren (1888) described the species based on five males and one female from Thundiani and noted that the species is closely related to *Thera juniperata*. Prout (1938, 1941) wrote that this species is similar to *T. cupressata* Herrich-Schäffer in the wing colour and he also pointed out the colour and size variation among the specimens of Thundiani, Kashmir and Simla.

Additional material examined. – INDIA: Paratype 1♀, Thundiani, 2.v.[18]87, Genitalia slide No. 3987; Simla, 7000 ft., 3♂ 2♀ A.E. Jones; Narkundah, 1♀, April.1888, H. McArthur coll.; Goorais Valley, 1♂, June.1887, J.H. Leech; Kashmir, Gulmorg, 3♂, 10.vi.[19]31, 12.vi.[19]31, 16.vi.[19]31, Fletcher coll. (BMNH); West Bengal, Darjeeling Dist. Tonglu, 3040 m, 2♀, 6.xi.1981, M. Owada (KY); N-Indien, Uttar Pradesh, Kumson Himalaya, Dist. Nainital, Bhimtal, 1500m, 1♀, 15-30.v.1990, A. Hauenstein (ZFMK). – NEPAL: Mustangbhot, 29°11' n. Br., 83°58' ö. L., Tagsa, 3500 m. 9.vii.[19]55, F. Lobbichler (BMNH); Gandaki above, Old Marpha. 3450m, 1♂, 12.viii.1996, M. Fibiger; 15 km SW, Kathmandu Hattiban pine for., 1500m, 1♀, 2.iii.1995, K. Mikkola & A. Wikberg; Godavari, 27°40'N 85°25'E, 15 Km SE Kathmandu, 1500 m, 1♀, 25.v.1996, A. Albrecht, O. Bistrom, K. Mikkola & A. Wikberg (ZMH); Kathmandu, Godavari 1600m, 1♂, 18.vii.1990, K. Yazaki (KY). – AFGHANISTAN: Afghanistan, 1♀, 84-41, Fletcher coll. (BMNH).

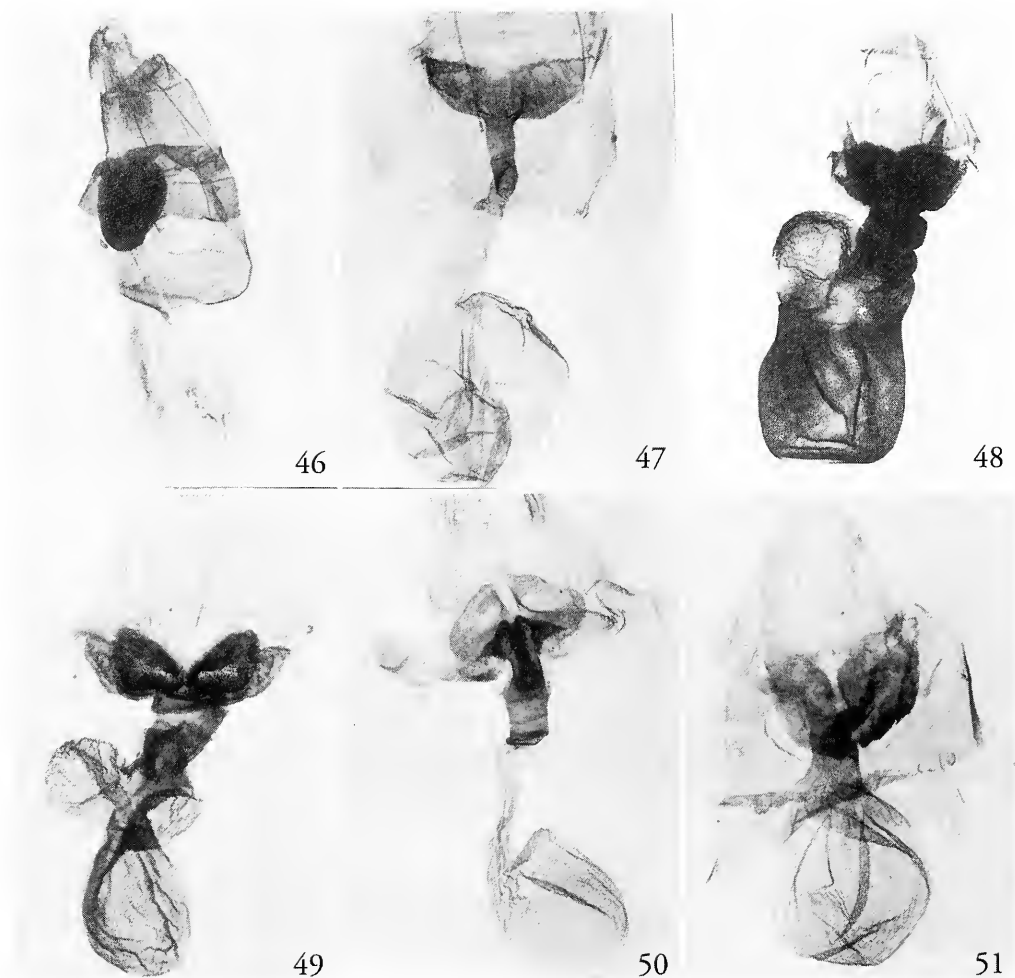
***Heterothera etes* (Prout) comb. n.**

(figs. 13, 53)

Thera etes Prout, 1926: 251. Holotype ♂, N. INDIA: Assam 5000ft. Shillong, Nov[ember] 1924, Fletcher leg. (BMNH) [examined]

Diagnosis

The species is very similar to *H. consimilis* in the wings and genitalia, but differs in the greyish wing ground colour, the process of sacculus and the three bundles of cornuti of the vesica.



Figs. 45-51. Female genitalia of *Heterothera*. – 46, *H. tephroptilus*; 47, *H. boenei*; 48, *H. yunnanensis*; 49, *H. eclinosis*; 50, *H. triangulata*; 51, *H. stamineata*.

Redescription

Antenna of male bipectinate, with long pectinations. Frons mixed with yellowish and yellowish brown scales, smooth. Labial palp long, about 1.5 times of eye diameter. Legs yellowish and yellowish brown. Metathorax with blackish tufts. Wingspan 26 mm. Forewing ground colour greyish; basal line blackish, dentate; antemedial line costally blackish, largely waved at middle and dorsum, medially indented; postmedial line blackish, medially and dorsally bulged; central fascia waved, discoidal dot long and distinct by uniting with costal part of antemedial line; subterminal line indistinct, pale whitish; apical streak light black-

ish; dorsum with black horizontal streak. Hindwing yellowish white; blackish postmedial line.

Male genitalia. – Uncus sclerotized, long about twice of tegumen height. Tegumen dome-shaped. Saccus broad, sclerotized, medially slightly invaginated. Juxta broad, sclerotized; anellus lobe long, digitiform, apically expanded with long hairs. Ventral part of valva medially invaginated, distally wide with a patch of hairs; costa sclerotized, medially much wider; sacculus triangular, dorsal border waved, with one distal process. Aedeagus cylindrical, sclerotized, medially slightly bent, distally densely scobinated; vesica small sac-like, cornuti spinular processes in three patches.

Female genitalia. – Papillae anales weakly sclerotized. Anterior apophysis 1/5 length of posterior apophysis. Antrum simple. Ductus bursae moderate, wall with sclerotized process. Corpus bursae ovate, signum absent.

Distribution

N. India.

Remarks

Prout (1926) noted that the species is similar to *Penithera comis* Butler and *H. consimilis* Warren. However, he distinguished *etes* based on its smaller size, reddish and weakly marked wing pattern elements and slender male abdomen. He (1941) noted that the species is somewhat similar to *Thera cyphoschema* Prout or *T. atrinotata* Joannis in the wing pattern, but it can be distinguished by the male antennal pectination.

Additional material examined. – INDIA: Paratypes 2♀, Assam 5000ft. Shillong, 2.vi.1924, Fletcher leg.; Khasis, 5000 ft. Shillong, 1♂, 25.v.1923, Fletcher coll.; Assam, Shillong, 1♀, H.M. Parish (BMNH).

Heterothera taigana taigana (Djakonov)

Cidaria taigana Djakonov, 1926: 27. Holotype ♂, RUSSIA: Sajon Mountains. Kasyr, E. Minusinsk, 7.viii.[19]24, L. & I. Koshantschikov (Djakonov 1926: 27) [not examined].
Asaphodes taigana; Viidalepp 1980: 65.
Viidaleppia taigana; Inoue 1982: 283.
Heterothera taigana; Choi 1997: 311.

Diagnosis

H. taigana is characterized by the dark ochreous or blackish ground colour of wings, small blackish dot at the dorsum and the costally smooth waving post-medial line of forewing. In the male genitalia the uncus, anellus lobe, costa, and sacculus are characteristic. The females of *taigana* are distinguished by the very large horn-like lamella postvaginalis.

Redescription

Antenna of male bipectinate, with short pectinations. Frons blackish. Labial palp about 1.5 times as long as eye diameter. Legs blackish with white tibial joints. Wingspan 27–33 mm. Forewing ochreous brown; basal line blackish, forming two vertical lines, waved, slanted; antemedial line waved, medially indented; postmedial line black, medially round, bulged; central fascia even in width, with black discoidal dot; subterminal line blackish, round; dorsum between basal and antemedial lines distinct with black dot. Hindwing blackish; discoidal dot black, small; postmedial line blackish.

Male genitalia. – Uncus sclerotized, twice as long as tegumen, basally tapered, medially bent. Tegumen

dome-shaped. Saccus shallow, broad. Anellus lobe large, horizontally expanded, rod-shaped, with long hairs on dorsal part. Valva sclerotized in general, distoventrally membranous; costa largely sclerotized, with distal end blunted; sacculus large, triangular, ventrally very slender, distoventrally with sharply pointed process. Acdeagus long, slender, sclerotized, distally scobinated; vesica tubular with small diverticula; cornuti mixed with large and small spines.

Female genitalia. – 8th segment sclerotized. Anterior apophysis absent. Posterior apophysis long, slender. Lamella postvaginalis with large horn-like sclerotized process; lamella antevaginalis plate-like, sclerotized. Ductus bursae short, broad, wall with sclerotized processes. Corpus bursae slightly slender or ovate.

Distribution

Russia (eastern Siberia).

Remarks

Djakonov (1926) noted its closeness to the *firma-ta*-group in the wing pattern.

Material examined. – RUSSIA: Irkutskaja obl., Hamar-Daban, taiga, Meteorolog st. 1450 m, 6♂ 1♀, 25–27.vii.1984, ad. luc. Mikkola & Viitasaari; Magadan obl., Upper Kolyma r. 62°N 149°40'E, 600 m scree slope ad. luc., 1♂, 16.vii.1987, K. Mikkola; 59°10'N 150°E, Magad. obl., Ohkotsk coast, 100 Km W. Magadan, 1♂ 2♀, 4–6.viii.1989, K. Mikkola (ZMH); Baikal, SW coast, Shumilikha river, 1♂, 10.viii.1972, (ZMI).

Heterothera taigana sounkeana (Matsumura)

Cidaria (*Thera*) *sounkeana* Matsumura, 1927: 184. Holotype ♂, JAPAN: Sounkei, Hokkaido (Mt. Daisetsu), 9.viii.1926, Matsumura leg. [not examined].
Thera kurilaria Bryk, 1942: 70. [Synonymized by Inoue 1955: 72].
Thera kurilaria ecce Bryk, 1942: 71. [Synonymized by Inoue 1955: 72].
Cidaria hospes Djakonov, 1955: 318.
Asaphodes sounkeana; Viidalepp 1980: 65.
Viidaleppia taigana sounkeana; Inoue 1982: 283.
Thera taigana ishizukai Inoue, 1955: 72. Holotype ♂, JAPAN: Mt. Jonen (2500m), Japan Alps, Nagano Pref., 26.vii.1951, H. Inoue (BMNH) [examined]. *syn. n.*

Diagnosis

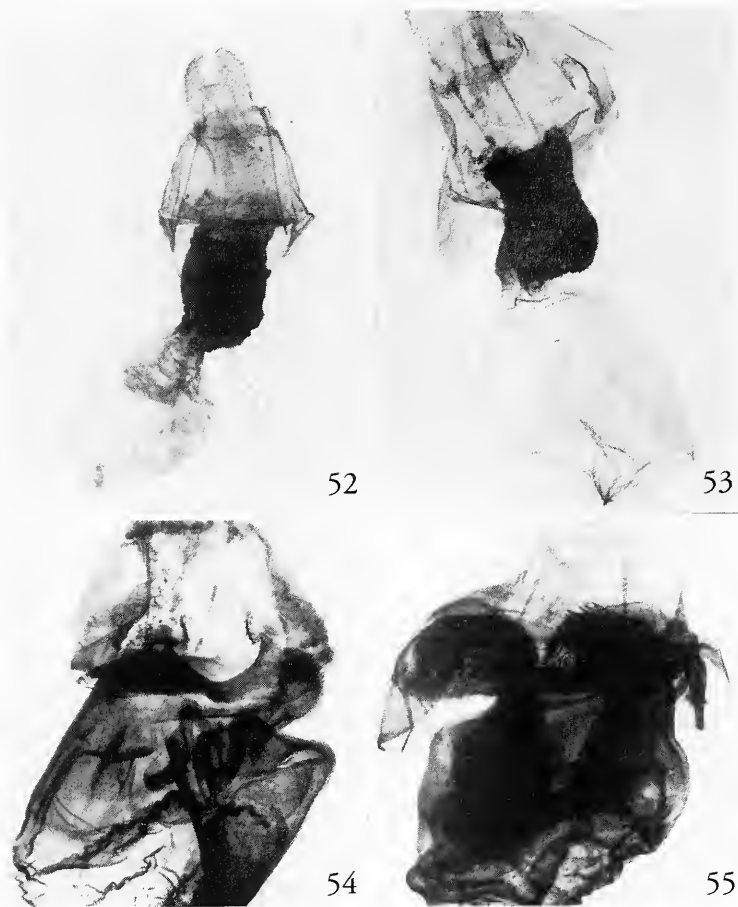
This subspecies is separated from the nominal subspecies by the presence of the signum in the corpus bursae.

Distribution

The Russian Far East, Japan.

Remarks

Inoue (1955) noted that *Thera kurilaria* Bryk might be the same species as *sounkeana* Matsumura on



Figs. 52-55.
Female genitalia of *Heterothera*. — 52, *H. consimilis*; 53, *H. etes*; 54, *H. serraria*; 55, *H. kurenzovi*.

the basis of the length of forewing and the structure of male genitalia. He (1977, 1982) listed two subspecies of *taigana* in Japan, *sounkeana* and *ishizukai*.

The subspecies *sounkeana* has the derived feature in the female genitalia; the presence of one signum patch in corpus bursae. This subspecies ranges from Amur through Kurile Islands to Japan.

In the original description of *ishizukai*, Inoue (1955: 72) wrote the differences between these two subspecies: "larger, and a little lighter in colour and postmedian line of forewing more weakly incurved in cellule 6, discal fleck a little less heavier than *sounkeana*." I have checked 3 type specimens of *ishizukai*, and the subspecific rank of *ishizukai* compared to *sounkeana* was very doubtful. Thus, I synonymized *ishizukai* with *sounkeana*.

Biology

Pinus pumila Regel is known as a host plant in Japan (Sato & Nakajima 1987).

Material examined. — RUSSIA: Kemerovo obl. Gornaya, Shoriya, 1 ♀, 24.viii.1965, Kononenko; Kurilid, Itunup, 1 ♂, 25.vii.1979, V. Junno; Sakhalin, Birjusinka, L., 1 ♀, 7-10.vii.1975, Viidalepp; Kurilid, Kunasir, Tretjakovo, 1 ♀, 22-24.vii.1980, Pototski, Ruben & Veldre (ZBI). — JAPAN: Mt. Daisetsu, Hokkaido, 1 ♂ 2 ♀, 29.vii.1978, Y. Kishida; Kamikawa Mt. Daisetsu, Hokkaido, 1 ♂, 20-21.viii.1993, H. Kobayashi (KY); Mt. Mitsumata Range 2560 m, 1 ex., 4.viii.1954, T. Haruta (ZMH).

Heterothera serraria (Lienig)
(fig. 54)

Cidaria serraria Lienig, 1846: 200. Holotype BALTIC (LATVIA). [not examined]

Gnophos serraria Herrich-Schäffer, 1847: 72.

Cidaria lienigiaria Lederer, 1853: 183 [Synonymized by Staudinger & Wocke 1871: 184].

Cidaria serraria Zeller; Staudinger & Wocke 1871: 184, Prout 1914: 219 [Incorrect authorship].

Melanippe ziczaccata Schöyen, 1875: 145. [Synonymized by Prout 1914: 219].

Larentia serraria ab. *continua* Strand, 1903: 16.

Larentia serraria ab. *albida* Stichel, 1911: 86.

Larentia serraria ab. *spania* Stichel, 1911: 86.

Asaphodes serraria; Viidalepp 1977: 576.

Viidaleppia serraria; Inoue 1986: 61.

Heterothera serraria; Choi 1997: 311.

Diagnosis

H. serraria is characterized by the whitish ground colour, blackish dots between basal and antemedial lines, medially broken central fascia, white and scalloped subterminal line of forewing and the blackish and scalloped subterminal line of hindwing. In the female genitalia, the antrum and very short and heavily sclerotized ductus bursae are distinguishing features. This species is very similar to the following two species, *H. serrataria* and *kurenzovi*, but differs in the termen of hindwing and the sterigma of female genitalia.

Redescription

Antenna of male bipectinate, with long pectinations. Frons whitish, round. Labial palp short, less than eye diameter. Metathorax dorsally white with blackish tufts. Wingspan 21–26 mm in male, 27–29 mm in female. Forewing ground colour whitish; basal line black, dentate; area between basal and antemedial line with blackish vertical band; antemedial line medially slightly indented; postmedial line costally waved, medially bulged; central fascia blackish, sometimes medially missing or reduced, discoidal dot large, blackish; termen blackish, subterminal line white, waving. Hindwing whitish; discoidal dot blackish; termen black with whitish, waving subterminal line. 1st tergal sclerite minute.

Male genitalia. – Uncus thin, shorter than tegumen, medially slightly bent. Tegumen bell-shaped. Saccus medially indented, broad. Juxta broad, sclerotized. Anellus lobe small round, sclerotized, very short hairs on top. Valva distally tapered; costa sclerotized, with medial expansion; sacculus well developed, distoventrally a large process. Aedeagus cylindrical, sclerotized; vesica tubular, cornuti large spinular.

Female genitalia. – Anterior apophysis absent, posterior apophysis long, slender. Lamella postvaginalis semi-circular covered with minute spines, lamella antevaginalis sclerotized, V-shaped with medially invaginated. Ductus bursae very short. Corpus bursae

large, posteriorly strongly sclerotized, with sclerotized striations at anterior part. Signum absent.

Distribution

Northern Europe to eastern Siberia.

Remarks

The *H. serraria*-group, comprising three species, *H. serraria*, *serrataria* and *kurenzovi*, is characterized by the wing pattern and the female genitalia. Among these species, the latter two species are sympatric in the Russian Far East. The species fly concurrently during July in southern Ussuri and Habarovsk. The species *kurenzovi* can be distinguished by more blackish coloration of the wing pattern elements and especially, by the genitalia of both sexes. The distal part of the aedeagus in *serrataria* is sclerotized and the cornuti are more or less small spinular processes, but the aedeagus of *kurenzovi* is distally sclerotized and also several spines are present at the vesica and the cornuti are the mixture of large and small spines in the vesica. In the female genitalia, the lamella antevaginalis of *serrataria* is a pair of triangular processes, whereas that of *kurenzovi* is a pair of rectangular processes.

Biology

Probably *Picea* is the host plant, and the species hibernates in the larval stage (Mikkola et al. 1985).

Material examined. – FINLAND: Seinäjoki, 1♂ 1♀, 30.vi.1931; Porvoo, Aminsby, 1♂ 1♀, 23.vi.1959, 24.vi.1970, E. Suomalainen. – RUSSIA: Murmansk district, 65 Km S. Monchegorsk, 3♂ 2♀, 19.vii.1993, A. Lvovsky; Murmansk district, Luvenga, White sea shore, 2♂ 1♀, 29.vi.1989, M. Kozlov; Petropolis, 1♂ 1♀, Coll. Duske; S-Ural, Cheliabinsk dist., Iremel mountain reserve, 900–1300 m, 7♂, 23–27.vi.1996, K. Nupponen, J.-P. Kaitila, J. Junnilainen & M. Ahola; Altai Sibir., 1♀, Coll. Winter; Irkutskaja obl., Hamar-Daban, taiga, Meteorolog st. 1450 m, 13♂ 4♀, 25–27.vii.1984, ad. luc. Mikkola & Viitasaari; Buryatia, 53°13'N 109°19'E, Barguzin valley 1000m, Ust-Barguzin-Yambul rd. taiga, 5♂, 13.vii.1996, Jalava & Kullberg (ZMH).

Heterothera serrataria (Prout) comb. n. (figs. 25, 36)

Cidaria (*Thera*) *serraria serrataria* Prout, 1914: 219. Holotype ♂, RUSSIAN FAR EAST: Kasakewitsch, Ussuri, in Coll. Püngeler (Prout 1914: 219) [not examined].

Cidaria (*Thera*) *serrataria*; Prout 1938: 115.

Asaphodes serrataria; Viidalepp 1977: 576.

Viidaleppia serrataria; Inoue 1986: 60.

Diagnosis

H. serrataria is very similar to *H. serraria*, but differs in the complete central fascia, the termen of hindwing without blackish subterminal line, the digitiform anellus lobe, the deep saccus and the lamella post- and antevaginalis.

Redescription

Antenna of male bipectinate, with long pectinations. Frons brownish black. Labial palp short, less than eye diameter. Wingspan 24-28 mm. Forewing ground colour whitish; basal line blackish, dentate; blackish vertical dots between basal and antemedial lines; antemedial line costally largely toothed, medially indented; postmedial line costally toothed with one deep invagination, medially bulged; central fascia blackish, with blackish discoidal dot; termen blackish; subterminal line waving, whitish. Hindwing whitish; basal blackish, with weak discoidal dot; postmedial line blackish. 1st tergal sclerite moderate projection.

Male genitalia. – Uncus short, sclerotized, basally tapered. Tegumen bell-shaped. Saccus broad, medially indented. Juxta broad, basally round. Anellus lobe digitiform, small hairs on top. Valva slim, distoventrally expanded; costa sclerotized, medially and distally expanded; sacculus triangular, sclerotized, distoventrally with process. Aedeagus cylindrical, distally strongly sclerotized; vesica tubular, cornuti spinular.

Female genitalia. – Anterior apophysis absent, posterior apophysis long, slender. Lamella postvaginalis large round processes with toothed surfaces, lamella antevaginalis broad, V-shaped, medially hollowed, covered with spines. Ductus bursae short, heavily sclerotized. Corpus bursae large, strongly sclerotized, with broad opening.

Distribution

The Russian Far East, Japan.

Remarks

Inoue (1986) listed this species under *Viidaleppia* on the basis of the genitalia. However, he was uncertain of its generic status because the species showed slender pectinations in male antenna which was similar to *Pennithera*, and single areole of forewing which was exceptional in *Thera*-group.

Jaros et al. (1992) recorded the species *H. serraria* from the Korean Peninsula. However, the record is very suspicious based on the distribution and I suppose that the specimen might be *H. serrataria* or *kurenzovi*.

Material examined. – RUSSIA: S-Ussuri, 1♂ 1♀, 9-12.vii.1976, Tsugujevski rj. DVNTS, Berjzovoi stats. DRL, Metsavir, Viidalepp, Ruben & Vasjurin; Habarovsk, Nelma, 2♀, 16-26.vii.1977, Viidalepp, Laanetu & Talve (ZBI); Pompejeffka, Amur, 2♂ 1♀ (BMNH). – JAPAN: Mt. Peipan, Asahikawa C. 1♂, 12.vii.83, Y. Kusunoki (BMNH).

Heterothera kurenzovi Choi, Viidalepp & Vasjurin sp.n. (figs. 14, 26, 37, 55)

Pennithera kurenzovi Viidalepp 1996: 23. [nomen nudum]

Type material. – Holotype ♂, RUSSIAN FAR EAST:

Habarovsk, Nelma, 16-26.vii.1977, Viidalepp, Laanetu & Talve leg. (ZBI). Paratype 1♀ S-Ussuri, Tsugujevski rj. DVNTS, Berjzovoi stats. DRL, Metsavir, 9-12.vii.1976, Viidalepp, Ruben & Vasjurin (ZBI).

Diagnosis

This species is very similar to *H. serrataria*, but differs in the more or less dark wing elements and medially broken central fascia. The long spinular processes at the distal part of the aedeagus, the very large spinular cornuti and the sterigma of the female genitalia are characteristic.

Description

Antenna of male bipectinate, with long pectinations. Frons brownish black. Labial palp short, less than eye diameter. Metathorax dorsally white with blackish tufts. Wingspan 26-28 mm. Forewing ground colour whitish; basal part blackish, basal line dentate; next to basal line are blackish, vertical dots; antemedial line costally and dorsally projected inward, medially indented; postmedial line generally waved, medially bulged; central fascia blackish, with strong blackish discoidal dot, medially broken; termen with round blackish, vertical band, subterminal line white, waved. Hindwing whitish, discoidal dot very weak; termen weak blackish spots. Metathorax whitish. 1st tergal sclerite with moderate process.

Male genitalia. – Uncus short, sclerotized, basally tapered. Tegumen bell-shaped. Saccus broad, medially indented. Juxta broad, sclerotized. Anellus lobe digitiform, apically with very short hairs. Valva basally broad, distally reduced; costa slender, sclerotized, medially largely expanded; sacculus triangular, sclerotized, distoventrally with a claw-like process. Aedeagus cylindrical, distally with spinular processes, cornuti large, spinular, scattered.

Female genitalia. – Anterior apophysis absent, posterior apophyses long, slender. Lamella postvaginalis semi-circular processes with dentate surfaces, lamella antevaginalis large plate-like structure densely covered with sclerotized processes. Ductus bursae very short, sclerotized. Corpus bursae large, opening with strongly sclerotized, anterior part with sclerotized striations.

Distribution

The Russian Far East (Primorye, Sikhote Alin Mts.), Sakhalin, N. Japan (Viidalepp 1996).

Remarks

Originally, the new species was described a decade ago by Viidalepp and Vasjurin on the basis of the material which is now preserved in the Institute of Biology and Pedology, Vladivostok. However, unfortunately this description had not yet been published. During my preparation of *Heterothera*, Dr. Viidalepp

kindly provided the material. Thus, here, we are describing this species jointly.

Heterothera firmata (Hübner) (fig. 24)

Geometra firmata Hübner, 1822: 515. Holotype Europe [not examined].
Thera consobrinata Curtis, 1834: 519 [Synonymized by Prout 1914: 219].
Thera simulata Stephens, 1831: 271 nec. Hübner, 1822 [Synonymized by Staudinger & Wocke 1871: 184].
Chesias ulicata Rambur 1834: 394; Staudinger & Wocke 1871: 184, Prout 1914: 219.
Larentia firmata; Herrich-Schäffer 1847: 171.
Cidaria firmata; Staudinger & Wocke 1871: 184.
Thera firmata; Viidalepp 1977: 576.
Thera firmata ab. *approximata* Lempke, 1950: 163.
Thera firmata ab. *brunneofasciata* Lempke, 1950: 163.
Thera firmata ab. *griseus* Lempke, 1950: 163.
Thera firmata ab. *interrupta* Lempke, 1950: 163.
Thera firmata ab. *purpureobrunnea* Cockayne, 1952: 267.
Asaphodes (*Pennithera*) *firmata*; Viidalepp 1980: 70.
Heterothera firmata; Choi 1997: 311.

Diagnosis

The wing pattern elements and the wing colour of *H. firmata* are somewhat similar to *Thera obeliscata*. However, *firmata* can be easily distinguished by the bipectinate male antenna, strongly indented antemedial line and the blackish discoidal line that is fused to the costal part of the antemedial line of forewing.

Redescription

Antenna of male bipectinate, with long pectinations. Frons yellowish brown. Labial palp long, double eye diameter. Legs yellowish brown, with pale tibial joints. Wingspan 24–30 mm. Forewing yellowish; basal line waved, occasionally costally strongly bulged; antemedial line costally blackish, medially deeply indented; postmedial line costally blackish, medially bulged; central fascia dark yellowish, dorsally reduced, blackish discoidal dot; subterminal line whitish, waved. Hindwing yellowish white, postmedial line very weak.

Male genitalia. – Uncus strongly sclerotized, medially bent, short being less than tegumen height. Tegumen triangular, shorter than vinculum. Saccus shallow, round. Juxta well developed, sclerotized. Anellus lobes digitiform, apically expanded and hairs present. Valva midventrally expanded; costa strongly sclerotized, with median and distal expansions; sacculus sclerotized, with distoventral process. Aedeagus cylindrical, sclerotized; vesica tubular, basally one patch of spinular cornuti present.

Female genitalia. – Anterior apophysis about 1/5 length of posterior apophysis. Antrum simple. Ductus bursae long, strongly sclerotized, basally thick, distally reduced. Corpus bursae ovate, small.

Distribution

Europe.

Remarks

Pierce (1914) first pointed out that the genitalia of *H. firmata* are different from *Thera* s.s. The species was transferred from *Thera* to *Pennithera* by Viidalepp (1980), and subsequently it was again moved from *Pennithera* to *Heterothera* (Choi 1997). The male and female genitalia of *firmata*, however, are somewhat different from the typical shape of *Heterothera* and the cladistic reanalysis of *Thera* and related genera (Choi unpublished) proposes that the species *firmata* is separated from *Heterothera*. Therefore, the generic position of the species is unclear.

Biology

The species is sometimes bivoltine in England and southern Europe (e.g. Bulgaria), although it is univoltine in northern Europe. *Pinus* is known as a host plant (Mikkola et al. 1985).

Material examined. – FINLAND: Porvoo, 1 ♂, 31.viii.1952, Seppänen; Sibbo, 1 ♂, 11.viii.1983, A. Albrecht; Tvärminne Biol. St., 1 ♀, 13.ix.1951, E. Suomalainen; Helsinki, 1 ♀, 25.viii.1971, A. Albrecht (ZMH). – AUSTRIA: Meran, Tirol, 1 ♀, coll. Winter (ZMH). – HUNGARY: Sopron, Tacsí drók, 1 ♂, 31.viii.1978, Ronkay; Sopron, Kovas d., 1 ♂ 1 ♀, 16.ix.1949, Ambrus; Peszterpuszta, Hungaria cent., 1 ♀, 24.ix.1949, Dr. Issekutz (HNHM). – BULGARIA: Rhodope Mt. Lukovitzta motel near Assenovgrad, 450 m, 1 ♂, 31.vii.1985, 2 ♂, 3.x.1986, S. Beschkov; S.W. Bulg. Kresnensko defile, Station Stara Kresna, 200 m, 1 ♂, 17.x.1987, S. Beschkov; Troyanska Stara planina mount. hur Dermenka, 1533 m, 1 ♀, 21.ix.1987, S. Beschkov (BNHM).

Thera cyphoschema Prout incertae sedis (figs. 40, 41, 56)

Cidaria (*Thera*) *cyphoschema* Prout, 1926: 312. Holotype ♂, N.E. BURMA: Htawgaw, 6000 ft. March 1923, A. E. Swann leg. (BMNH) [examined].

Thera cyphoschema; Prout, 1941: 323.

Cidaria atrinotata Joannis, 1929: 485. Holotype ♂, VIETNAM: Hoang su phi, Tonkin in Paris Museum (colour transparency in BMNH, [examined]). syn. n.

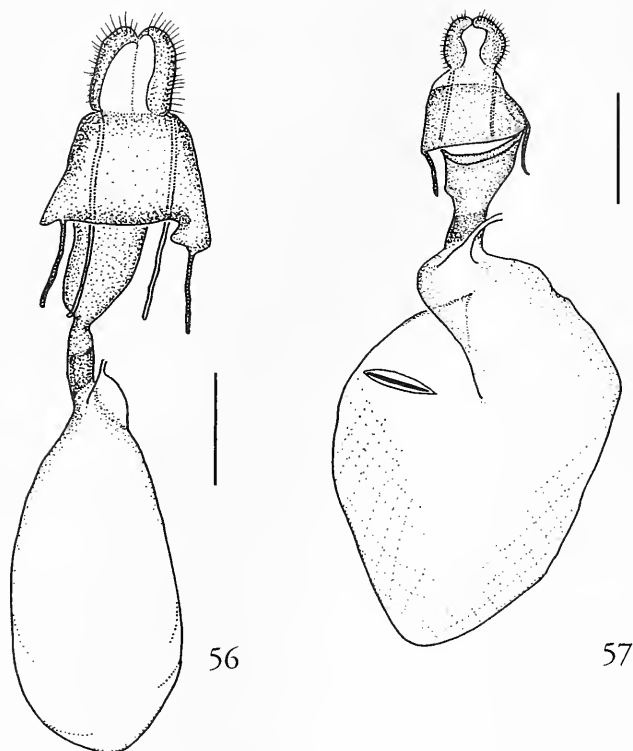
Cidaria atrinotata reducta Joannis, 1929: 486. syn. n.

Diagnosis

This species is similar to *H. mussooriensis* in the wing pattern, but differs in the short pectinations of the male antenna and the relatively short and thick uncus, round saccus, unsclerotized costa of valva, the presence of diverticulum of vesica and the absence of cornutus.

Redescription

Antenna of male bipectinate, with short pectination. Frons reddish and white scales. Labial palp brownish and white, long about twice the eye diameter. Legs



Figs. 56-57.
Female genitalia of *Thera* s.l. – 56,
T. cyphoschema; 57, *T. exangulata*.
Scale bar = 1 mm.

brownish and white scales, with white tibial joints. Wingspan 26 mm. Forewing ground colour greyish; basal line blackish, slanted; antemedial line costally blackish, medially indented; postmedial line black, medially bulged; central fascia thin, medially reduced, blackish on veins; dorsum with short blackish line at base. Hindwing whitish, discoidal dot blackish, post-medial line very weak.

Male genitalia. – Uncus thick, relatively short less than half of tegumen, sclerotized. Tegumen dome-shaped. Juxta broad, sclerotized; anellus lobe digitiform, medially and apically with long hairs. Saccus round, medially concave. Valva generally membranous; costa membranous, distally slightly projected upward; sacculus triangular, basally sclerotized, with a distal large spinular projection. Aedeagus slender, sclerotized; vesica tubular with one large lateral diverticulum; cornutus absent.

Female genitalia. – Anterior apophysis half of posterior apophysis. Sterigma simple, laterally with thin, sclerotized stripes. Antrum large, funnel-shaped. Ductus bursae with colliculum in middle. Corpus bursae large, subspherical, signum absent.

Distribution

Burma, S. China, N. Vietnam.

Remarks

The species is similar to *Heterothera* in the bipectinate male antenna, the wing pattern and the male genitalia, but it is very different from *Heterothera* in the female genitalia, particularly the funnel-shaped antrum and the presence of a colliculum. Thus, the inclusion of the species in *Heterothera* is equivocal.

Additional material examined. – BURMA: Paratypes 3♂, Htaungaw, N.E. Burma, 6000 ft. IV-V.1923, A.E. Swann.; Htaungaw, N.E. Burma, 6000 ft, 1♂ 3♀, IV-V.1923, A.E. Swann. – VIETNAM: Paratype 1♂, Hoang su phi, Tonkin. – CHINA: Tseku (Tse-Kou), Prov. Yunnan, 3♂, 1895, 2♂, 1898, 5♂, 1900, R.P.J. Dubernard (BMNH).

Thera exangulata (Warren) incertae sedis
(figs. 42, 43, 57)

Perizoma? exangulata Warren 1909: 127. Holotype ♀, N. INDIA: Srinagar, Kashmir 7000ft, collection]. Ward. 20.VI.[19]04 (BMNH) [examined].

Cidaria (Thera) exangulata Prout 1938: 113.

Thera exangulata; Prout 1941: 323.

Diagnosis

The species can be distinguished by the black and medially reduced central fascia and white scalloped subterminal line of forewing. This species is similar to *Cidaria deletaria* Hampson in the male genitalia (the slender and sclerotized costa), but differs in the wing pattern elements.

Redescription

Antenna of male filiform. Frons smooth, mixed with ochreous and brownish scales. Labial palp short. Legs dark brownish, with ochreous tarsal joints. Wingspan 32 mm. Forewing basal part dark brownish, slanted; antemedial line costally expanded, slanted; postmedial line medially dentate, bulged; central fascia blackish, costally pale brownish, medially reduced, with long black discoidal dot. Termen brownish, medially paler; subterminal line whitish, scalloping; apical streak brownish. Hindwing whitish; basal part tinged with blackish, with blackish discoidal dot; postmedial line blackish; termen dorsally slightly tinged with black.

Male genitalia. – Uncus about twice as long as tegumen, basally tapering. Tegumen dome-shaped. Saccus round, medially expanded. Juxta broad; anellus lobe long, rod-shaped, dorsally with long hairs. Transtilla sclerotized, thin, round. Valva slender; costa long, slender, distally with long sclerotized hairs; sacculus indistinct. Aedeagus cylindrical, sclerotized, ductus ejaculatorius distally sclerotized; vesica large sac-like, cornutus absent.

Female genitalia. – Papillae anales simple, sclerotized. 8th segment slightly sclerotized. Anterior apophysis about 3/5 length of posterior apophysis. Antrum broad, funnel-shaped. Ductus bursae short, with colliculum. Corpus bursae very large, subovate, posteriorly with many striations; signum a long thread-like process.

Distribution

N. India.

Remarks

Warren (1909) described the species under *Perizoma*, but Prout (1938 & 1941) listed it under *Thera*.

The wing pattern and especially the female genitalia of the species (funnel-shaped antrum, the presence of colliculum and the thread-like signum) are different from *Thera* s.l. The male genitalia of *exangulata* are similar to *Cidaria deletaria* Hampson, whereas the antrum of female genitalia is similar to *T. cyphoschema*. The systematic position of the species remains unclear.

Additional material examined. – INDIA: Kashmir, 7000 ft, 2♂, 24.vi.; Mussu Hills, 2♂ (BMNH).

***Pennithera distractata* (Sterneck) comb. n.**
(figs. 44, 45)

Thera distractata Sterneck, 1928: 152. Holotype ♀, CHINA: Wassukou (Wassekou), Prov. Sichuan [not examined].

Diagnosis

The species is similar to *H. serraria* and *H. serrataria* in the wing pattern elements, but it can be distinguished by the short pectinations of male antenna, its wider central fascia and the male genitalia. The well developed bilobed anellus lobe and the medial process at the costa of valva in the male genitalia are characteristic.

Description

Antenna of male bipectinate, with short pectinations. Frons with white and blackish scales. Labial palp moderate about 1.5 times the eye diameter. Legs with whitish tibial joints. Wingspan 25 mm in male. Forewing ground colour whitish; basal line blackish, wavy; area between basal and antemedial lines tinged with blackish, bar-shaped band; antemedial line wavy; postmedial line costally dentate, invaginated, medially slightly bulged; central fascia blackish, relatively constant in width, with black discoidal dot; termen blackish. Hindwing whitish; discoidal dot small blackish, with blackish postmedial line; termen with black, waving subterminal line; fringe black.

Male genitalia. – Uncus long, slender. Tegumen small, dome-shaped. Juxta basally invaginated; anellus lobe bilobed with club-shaped large lobe and densely hairy small lobe, apical part of large lobes with long hairs. Saccus sclerotized, round with medial projection. Valva slender; costa sclerotized, with a medial triangular process. Aedeagus slender, medially bent, distally slightly scobinated; cornutus small process.

Female genitalia. – Unknown.

Distribution

S.W. China.

Remarks

The species has never been reported since its original description (Sterneck 1928). The identification of the species is based on the original description and drawing.

The combination with *Pennithera* is based on the following characters: the relatively smaller tegumen, the triangular process at the middle of the costa and the indistinct sacculus of the male genitalia. The bilobed anellus lobes of the male genitalia are very characteristic.

Material examined. – CHINA: 1♂ A-tun-tse, (Nord-Yunnan), Obere Hohe, ca. 4500 m, 13.vii.1937, H. Höne (ZFMK).

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BOOK REVIEWS: ORTHOPTERA SOUNDS

D.R. Ragge & W.J. Reynolds, 1998. The songs of the Grasshoppers and Crickets of Western Europe. – Harley Books, Colchester. 591 pp., 3 colour plates, 24,4 x 17,2 cm, clothbound. [ISBN 0-946589-49-6]. Price £ 65.00 excl. p&p.

D.R. Ragge & W.J. Reynolds, 1998. A sound guide to the Grasshoppers and Crickets of Western Europe. – Harley Books, Colchester. Jewel box with 2 cd's, 120 minutes, booklet 20 pp.. [ISBN 0-946589-50-X]. Price £ 25.00 excl. p&p.

The editors received the book and the cd-booklet for review, but for completeness sake I'll also include the cd's themselves here. Below I also take the opportunity to briefly review the other recent European books and cd's containing Orthoptera sounds. Being an editor and co-author of the Dutch book and cd myself, I'll try to be as objective as possible.

The book and cd's by Ragge & Reynolds are the first to treat the songs of the majority of Western European singing Orthoptera in full detail (Heller made a more complete review of bush-crickets only). The book describes the songs of 170 species occurring in western Europe and Scandinavia, including Finland, Austria, Italy and the western Mediterranean islands. Each description comprises the full Latin name and original citation; vernacular names of the major languages of the countries covered; a complete set of references to earlier song descriptions and recordings; a paragraph on recognition; full description of the song in its various types (calling song, courtship, rivalry song etc.) and a paragraph on distribution. The songs are illustrated by ca. 1600 oscillograms. All the songs are also included in the accompanying cd's, in relatively short fragments (ca 25 seconds each). Three colour plates give an impression of the diversity of the singing Orthoptera in western Europe.

The introduction gives many technical details on recording and other acoustic methods, and provides a general introduction and reviews of sound production in Orthoptera and nature and function of songs.

In the introduction the used nomenclature is explained for difficult cases. A final introductory chapter discusses the value of songs in taxonomy and identification.

The book is a major contribution to Orthoptera systematics, it not only describes the songs of many species, but also includes the many taxonomic results which were published by these and other authors in earlier papers. The careful study of the songs has in many cases lead to a better understanding of complex groups, such as the *Chorthippus biguttulus* group. The

authors could reduce many dubious very local forms into synonyms of more widespread species. The cd's, oscillograms and key are very handy tools for the identification on the basis of sound. I like the inclusion of the similar sounds of the four larger cicadas, two toads and five bird-species. I only wonder why the toad *Bufo calamita* is not included: here in Holland it's song is often confused with *Gryllotalpa* song.

The species included are apparently chosen on the pragmatic basis of material available. They represent all common and most rarer species, but nowhere the authors explain what proportion of Orthopteran species they actually represent. Also missing is a list of the not-singing groups which are not covered. In some groups the selection seems rather artificial, such as the Locustinae, where *Psophus stridulus* and *Bryodemus tuberculatus* are treated, but the similar *Oedipoda*-species, which also make sounds, not. This is the only point of criticism on an otherwise very useful and important book and cd-set, that I'll recommend warmly for all those interested in Orthoptera.

Other titles

H. Bellmann, 1993a. Heuschrecken beobachten, bestimmen. – Naturbuch Verlag, Augsburg [Second revised edition], 349 pp. [ISBN 3-89440-028-5]. [in German]

H. Bellmann, 1993b. Die Stimmen der heimischen Heuschrecken. – Weltbild Verlag Augsburg, audio-cd.

H. Bellmann & G. Luquet, 1995. Guide des sauterelles, grillons et criquets d'Europe occidentale. – Delachaux et Niestlé, Lausanne, 383 pp. [ISBN 2-603-00974-5]. Price appr. NLG 80. [In French]

F.-R. Bonnet, 1995. Guide sonore des sauterelles, grillons et criquets d'Europe occidentale. – Delachaux et Niestlé, Lausanne, Audio-cd. [ISBN 2-603-00975-3]. Price appr. NLG 30.

R.M.J.C. Kleukers, E.J. van Nieukerken, B. Odé, L.P.M. Willemsse & W.K.R.E. van Wingerden, 1997. De sprinkhanen en krekels van Nederland (Orthoptera). – Nederlandse Fauna 1. Nationaal Natuurhistorisch Museum, KNNV Uitgeverij & EIS-Nederland, Leiden. 408 pp., 14 plates. [ISBN 90-5011-100-9]. price NLG 82.50 including cd, excl. p&p. [In Dutch, extensive English summaries] [end 1998: almost sold]

B. Odé, 1997. De zingende sprinkhanen en krekels van de Benelux. Audio-cd, included with book Kleukers et al..

Both Bellmann guides are new editions of his earlier fieldguide in German, of which also an English translation exist. They treat many species which were not earlier included, and therefore extent the region of use enormously. With the magnificent photographs

TELEOPSIS RONDANI (DIPTERA, DIOPSIDAE):
GENERIC REVIEW AND THE *FERRUGINEA* GROUP
FROM SRI LANKA

Feijen, H. R., 1998. *Teleopsis* Rondani (Diptera, Diopsidae): generic review and the *ferruginea* group from Sri Lanka. – Tijdschrift voor Entomologie 141: 49-63, figs. 1-33, table 1. [ISSN 0040-7496]. Published 30 November 1998.

Teleopsis Rondani is defined. A catalogue is presented for the 19 species now recognized, while the systematic history of the genus is discussed. New synonymies are proposed and several old synonymies rejected. Various characters of taxonomic importance are discussed. For all species, data are provided on two quantitative characters: ratio eye span/body length and ratio length/width of front femur. Both characters show a correlated interspecific variation from strong sexual dimorphism to homomorphy. A key is provided to the five Diopsidae known to occur in Sri Lanka. From Sri Lanka *Teleopsis ferruginea* Röder is redescribed, while two new species are described: *Teleopsis krombeini* sp. n. and *Teleopsis maculata* sp. n.

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Keywords. – Diptera; Diopsidae; *Teleopsis*, revision; new species; redescription; catalogue; sexual dimorphism; Oriental; Sri Lanka.

The genus *Teleopsis* was created by Rondani in 1875. As type-species, Rondani designated *Diopsis sykesii* Gray, though Westwood is now commonly considered the author of this species. No formal diagnosis was given. Only in his key to the 'Stirps. Diopsidinae', Rondani gave the indication 'Thoracis aculei quator: scutelli duo' [thorax with four spines: scutellum with two]. Notwithstanding the shortness of the genus definition, it sufficed to characterize the genus. With 'Thoracis aculei quator' Rondani referred to the pair of metapleural spines present in all Diopsidae and the pair of supra-alar spines only present in *Teleopsis*, while 'scutelli duo' referred to the scutellar spines present in all Diopsidae. Some confusion was caused by *Cobiopsis latifascia* (Brunetti 1928c), which has a pair of intra-alar spines and which, due to its six thoracic spines, was originally placed in *Teleopsis* (see Feijen 1989).

Frey (1928) erected the genus *Megalabops* for *Diopsis quadriguttata* Walker, though Brunetti (1928a/b) placed this species in *Teleopsis*. Frey also did not produce a formal diagnosis. Only in his key to the genera he gave for *Megalabops* 'Innere Orbitale nur ganz kurz gestielt, auf der Mitte des Stiels. Die Rückendornen

ganz kurz' [IVB with a quite short base, placed in the middle of the eye stalk. The thoracic spines quite short]. For *Teleopsis* Frey stated 'Innere Orbitale auf einem langen, dicken Stiel stehend, basal gelegen. Die Rückendornen lang' [IVB standing on a long stalk-like base and more basally located. The thoracic spines short]. Steyskal (1972) placed *Megalabops* in synonymy with *Teleopsis*, stating that the former only differed from the latter 'in degree of development of same characters'. Feijen (1989) followed Steyskal's view, stressing that for an eventual later division of *Teleopsis* s. l. different differential characters will have to be used. Further research now revealed that *sykesii*, the type-species of *Teleopsis*, would also fall under *Megalabops* using Frey's criteria. This rather definitively sinks *Megalabops* Frey. The confusion was caused by '*T. sykesii*' Frey not being conspecific with *T. sykesii* (Westwood). True *Teleopsis* species are so far only recorded from the Oriental Region, while one species is known from Madagascar. Shillito (1971a) showed that, except for the one Madagascan species, *Teleopsis* does not occur in Africa and that various African diopsids were erroneously referred to it.

This paper should be considered as the first contri-

bution towards a monograph on *Teleopsis*. About five contributions are intended, in which all seventeen recognized species will be redescribed. Besides the two new species from Sri Lanka presently described, thirteen additional new species from China, India, Indonesia, Malaysia, Myanmar (Burma) and Vietnam will be described. This first contribution presents a genus diagnosis, a catalogue and notes on differential and quantitative characters. In the catalogue various new synonymies are proposed and several old synonymies rejected. The first species treated are the ones from Sri Lanka.

The three *Teleopsis* species of Sri Lanka form their own group in the genus: the *ferruginea* group. A key to the various groups recognized within *Teleopsis* will be presented in a later contribution, as will be a key to all species. Besides the three *Teleopsis* species, only two other diopsids are known to occur in Sri Lanka. *Sphyracephala bipuncipennis* (Senior-White 1922) was described from Sri Lanka. It was originally placed in *Teleopsis* and transferred to *Sphyracephala* by Feijen (1989). The second species is a *Diopsis* near *indica* Westwood 1837a. The *Diopsis indica* complex still needs to be revised.

ABBREVIATIONS USED

BMNH	British Museum (Natural History), London
BPBM	Bernice P. Bishop Museum, Hawaii
CNMS	National Museum Sir Marcus Fernando Mawatha, Colombo, Sri Lanka
DEIC	Deutsches Entomologisches Institut, Eberswalde
IVB	Inner Vertical Bristle
MCSNG	Museo Civico de Storia Naturale 'Giacomo Doria', Genua
MLUH	Wissenschaftsbereich Zoologie, Sektion Biowissenschaften, Martin-Luther- Universität, Halle
MNHNP	Muséum National d'Histoire Naturelle, Paris
NMW	Naturhistorisches Museum, Wien
OVV	Outer Vertical Bristle
RMNH	Nationaal Natuurhistorisch Museum Naturalis, Leiden (formerly Rijksmuseum van Natuurlijke Historie)
UMO	Hope Entomological Collections, University Museum, Oxford
USNM	United States National Museum of Natural History, Washington
UZMH	Zoological Museum, University of Helsinki
ZMA	Zoologisch Museum, Amsterdam

GENUS TELEOPSIS RONDANI

Teleopsis Rondani (1875: 442). Type species *Diopsis sykesii* Westwood 1837a, by original designation.

Megalabops Frey (1928: 70). Type species *Diopsis quadriguttata* Walker 1856a, by original designation.

Diagnosis

Small to large diopsids with small to extremely large eye stalks; bipartite arista; OVB varying from very short to long, sometimes spinous; IVB varying from short to long, base of IVB varying from small elevation to long, stalk-like cone; facial sulcus present; facial teeth present or absent; precoxal bridge present; supra-alar spines present, intra-alar spines absent; scutal bristles absent; scutellum dorsally flat or convex, scutellar spines strong and curved, apical bristle small to medium-sized (half the length of the spine); metapleural spines small to medium-sized, posterolaterally directed; front femora very slender to strongly incrassate, with two rows of tubercles along most of ventral side; femora without apical spurs; mid tibiae with two small subapical bristles; alula absent, sixth vein not extending beyond anal cell, fifth vein extending beyond posterior crossvein but not reaching wing margin, wing varying from irrorate to hyaline with brown bands, glabrous basal area varying from small to large; abdomen strongly clavate, slender basal section long, syntergum consisting of terga 1, 2 and 3, seam between terga 2 and 3 usually indistinct; base of sternum 1 in varying degrees fused to syntergum, other sterna rather narrow and medially located; spiracle 1 in tergum or in sclerotized area between tergum and sternum; between sterna 1 and 2 a small band-like sclerite; female sterna 5, 6 and 7 usually single sclerites (sometimes one or more are medially divided); female terga 7 and sterna 7 in some species connected via basal sclerotized band; female terga 8 and sterna 8 both consisting of two sclerites; female spiracle 7 usually in membrane; male spiracle 7 often in sternum 7+8; three spermathecae with tooth-like ornaments; spermathecal ducts with U-turns near the spermathecae; male sternum 6 absent; gonostyli usually articulated, sometimes fused with perianthrium; phallopodeme strongly built; processus longi only running from gonostylus to cercus (processus not distinguishable in species with non-articulate gonostyli); sexual differences in eye span and front femora vary from homomorphy to strong dimorphy (larger mean eye spans and longer and more slender front femora in males).

Teleopsis is characterized as a monophyletic group by the following groundplan conditions which are apomorphic with respect to the groundplan (see Feijen 1989) of the Diopsidae:

- (1) supra-alar spines present.
- (2) sternum 1 basally fused to syntergum.
- (3) spiracle 1 in sclerite.
- (4) spermathecal ducts with U-turns near the spermathecae.

Catalogue

Teleopsis Rondani, 1875: 442

Type species *Diopsis sykesii* Westwood 1837a, by original designation.

= *Megalabops* Frey, 1928: 70

Type species *Diopsis quadriguttata* Walker 1856a, by original designation.

Ref.: Steyskal 1972: 11; Feijen 1989: 62.

adjacens Brunetti, 1928b: 276 (without description in Brunetti 1928a: 272)

Holotype from Talum, Thailand (BMNH).

belzebuth Bigot, 1874: 113 (*Diopsis*)

Holotype from Borneo (UMO).

Ref.: Bigot 1880: 94; not '*belzebuth*'; Hendel 1913: 37 (= *bigoti* Hendel); Hendel 1914: 94; Brunetti 1928a: 272 (synonymy established by E.E. Austen); Frey 1928: 72; Shillito 1971b: 301.

= *discrepans* Walker, 1856b: 134

In part, two of the three syntypes of *discrepans* are conspecific with *belzebuth*. Syntypes from Sarawak, Borneo, Malaysia (BMNH).

= *fallax* Bigot, 1874: 111 **syn. n.**

Holotype from Borneo (UMO, fragment).

Ref.: Bigot 1880: 94.

= *longiscopium* Rondani, 1875: 444

Holotype from Sarawak, Borneo, Malaysia (MCSNG).

Ref.: Brunetti 1928a: 272 (as synonym of *discrepans*, a synonymy established by E. E. Austen); Guiglia 1957: 197.

bigoti Hendel, 1914: 94

Type-series from Chip-Chip, Taiwan (NMW and BMNH).

Ref.: Hendel 1913: 37 (as *belzebuth*); Brunetti 1928a: 270 (junior synonym of *quadriguttata*) and 272 (junior synonym of *discrepans*); Matsumura 1931: 371 (as *Sphyracephala quadriguttata*); Shiraki 1932: 24; Hennig 1941a: 58 (as '*Megalabops quadriguttata*'); Hennig 1941c: 135 (as *Megalabops bigoti*); Chen 1949: 2 (as possible synonym of *discrepans*); Steyskal 1972: 12 (junior synonym of *quadriguttata*).

boettcheri Frey, 1928: 75

Type-series from Carbalogan and Panaon on Samar and from Dansalan, Mumungan, Butuan and Surigao on Mindanao, Philippines (UZMH).

Ref.: Tenorio 1969: 483.

breviscopium Rondani, 1875: 443

Holotype from Sarawak, Borneo, Malaysia (MCSNG).

Ref.: Brunetti 1928a: 272 (as synonym of *discrepans*, a synonymy established by E.E. Austen); Guiglia 1957: 197.

discrepans Walker, 1856b: 134 (*Diopsis*)

Mixed type-series from Sarawak, Borneo, Malaysia (BMNH). Two of the three types are conspecific with *belzebuth*.

Ref.: Brunetti 1907: 165; Brunetti 1928a: 270; Chen, 1949: 2 (as possible synonym of *bigoti*); Tan 1965 (in part); not Burkhardt & de la Motte 1985: 204; not Feijen 1989.

ferruginea Röder, 1893: 235 (*Diopsis*)

Type from Southern Sri Lanka (MLUH).

Ref.: Frey 1928: 70 (as possible *Megalabops*); not '*ferruginea*' Curran 1936: 2 (= *Cyrtodiopsis currani*, Shillito 1940: 159); Shillito 1940: 157 (as *Megalabops*).

krombeini sp. n.

Type-series from Sri Lanka. Holotype and paratypes in USNM, paratypes in BMNH, RMNH and CNMS.

maculata sp. n.

Type-series from Sri Lanka. Holotype and paratype in BMNH, paratype in USNM.

motatrix Osten Sacken, 1882: 236

Type-series (four out of five fragments) from the Philippines (DEIC).

Ref.: Wulp 1897: 193 (as possible synonym of '*sykesii*' Wulp); Frey 1928: 71; Tenorio 1969: 483.

onopyxus Ségué, 1949: 67

Holotype and two paratypes from Madagascar (MNHN).

pharao Frey, 1928: 74

Type-series from Banahao on Luzon, Philippines (UZMH).

quadriguttata Walker, 1856a: 37 (*Diopsis*)

Type-series from Malacca, Malaysia (BMNH and MNHN).

Ref.: Wulp 1897: 196 (as possible senior synonym of *rubicunda*); Brunetti 1907: 165; Brunetti 1928a: 270 (in part, not Taiwan specimens); Frey 1928: 70 (as type-species of *Megalabops*); not '*Sphyracephala quadriguttata*' Matsumura 1931: 371 (= *bigoti*); not '*Megalabops quadriguttata*' Hennig 1941a: 58 (= *bigoti*); Tan 1965: 25; Steyskal 1972: 12 (as senior synonym of *bigoti*); Burkhardt & de la Motte 1985: 204.

[= *fenestrata* Bigot, nomen nudum. In part.

Type-series from India, UMO.

Ref.: Brunetti 1907: 165; Steyskal 1972: 11.]

rubicunda Wulp, 1897: 196 (as possible synonym of *quadriguttata*)

Type-series of Sukabumi, Java and Hili Madjeja, Nias (near Sumatra) (one fragment of Nias type in ZMA).

Ref.: Meijere 1908: 117; Meijere 1916b: 90; Meijere 1924b: 204; Brunetti 1928a: 270 (Sri

Lanka material is *krombeini*); Frey 1928: 75 (doubtful identification); Frey 1934: 335; nec Tan 1965: 27 (= *sexguttata*).
selecta Osten Sacken, 1882: 236
Holotype from Philippines (DEIC).
Ref.: Frey 1928: 77.
sexguttata Brunetti, 1928b: 275 (without description in Brunetti 1928a: 272)
Type-series from Bukit Besar, Thailand (BMNH).
shillitoi Tenorio, 1969: 483
Type series from Sulu, Mindanao, Philippines (holotype and paratypes in BPBM, paratypes in USNM and BMNH).
sykesii Westwood, 1837a: 310 (*Diopsis*)
Type series from Hurreechunderghur, Deccan, India (UMO).
Ref.: Rondani 1875: 443; not '*sykesii*' Wulp 1897: 193; Brunetti 1907: 165; Brunetti 1928a: 270 (not Borneo reference); not '*sykesii*' Meijere 1911: 366; not '*sykesii*' Meijere 1916b: 89; not '*sykesii*' Meijere 1919: 32; not '*sykesii*' Frey 1928: 72; not '*sykesii*' Tenorio 1969: 483.
= *fulviventris* Bigot, 1880: 94 **syn. n.**
Holotype from India (UMO).
trichophora Meijere, 1916b: 89 (as *trichophoras*)
Type-series from Sibolga and Fort de Kock, Sumatra (lectotype and paralectotypes in ZMA,

paralectotypes in RMNH).
Ref.: Meijere 1916a: 40 (as *trichophorus*, without description); Meijere 1916c: 132 (change in *trichophora*); Meijere 1924a: 60.

Discussion

Former catalogues of *Teleopsis* were given by Brunetti (1907, Oriental), Brunetti (1928a), Descamps (1957, Afrotropical), Steyskal (1972), Steyskal (1975, Oriental) and Cogan and Shillito (1981, Afrotropical). Quite a number of species were erroneously placed in, or transferred to *Teleopsis*. Westwood (1837b) showed in his figures of *Diopsis wiedemanni*, *Diopsis erythrocephala* and *Diopsis arabica* supra-alar spines. Therefore Brunetti (1928a) and Descamps (1957) placed the three species in *Teleopsis*. However, all three species are clear *Diopsis*. Hennig (1941b) corrected the error for *arabica*, Séguy (1955) for *erythrocephala* and Shillito (1971a) for *wiedemanni*. *Teleopsis nitida* Adams, 1903 was placed in *Diopsina* by Feijen (1978) and Cogan and Shillito (1981). Brunetti (1928a) placed *Diopsis leucochira* Bezzi, 1908 and *Diopsis sulcifrons* Bezzi, 1908 by mistake in *Teleopsis*. Brunetti (1928b) described *truncata* as a *Teleopsis*, but Shillito (1940) correctly placed it in *Cyrtodiopsis*, though erroneously in synonymy with *C. dalmanni* (Wiedemann) (see Feijen 1981).

Table 1. Sexual dimorphism or homomorphy for eye span and shape of front femur for the 19 recognized *Teleopsis* species. For each species a maximum of 20 specimens was measured per sex.

<i>Teleopsis</i>	Ratio Eye span/ body length			Ratio length/ width of front femur			No. of flies examined	
	♀	♂	Category	♀	♂	Category	♀	♂
<i>belzebuth</i>	0.98	2.00		4.8	6.7		10	23
<i>motatrix</i>	0.95	1.77	strong dimorphy	4.4	5.7	strong dimorphy	4	11
<i>shillitoi</i>	0.89	1.55		4.5	5.8		18	10
<i>trichophora</i>	0.93	1.61		5.2	6.2		12	15
<i>adjacens</i>	0.88	1.11	moderate dimorphy	4.4	4.8	moderate dimorphy	32	12
<i>breviscopium</i>	0.98	1.41		4.6	5.2		6	2
<i>discrepans</i>	1.00	1.49		4.6	5.2		23	39
<i>pharao</i>	0.86	1.34		4.6	5.1		3	9
<i>rubicunda</i>	0.82	1.25		4.0	4.9		22	14
<i>sykesii</i>	0.94	1.19	weak dimorphy	4.1	4.2	homo-morphy	114	67
<i>onopyxus</i>	0.91	-		3.6	-		3	0
<i>boettcheri</i>	0.84	0.98		4.0	4.2		16	30
<i>ferruginea</i>	0.84	0.98	homo-morphy	4.5	4.5	homo-morphy	16	30
<i>krombeini</i>	0.81	1.00		3.8	3.8		9	9
<i>bigoti</i>	0.63	0.67	homo-morphy	3.8	3.8	homo-morphy	81	91
<i>quadriguttata</i>	0.72	0.69		3.0	3.2		4	10
<i>sexguttata</i>	0.71	0.73		3.3	3.3		14	5
<i>maculata</i>	-	0.63	-	-	4.9	-	0	2
<i>selecta</i>	-	0.84	-	-	4.4	-	0	2

Descamps (1957) placed *sulcifrons* again in *Diopsis* and Shillito (1971a) and Steyskal (1972) referred *leucochira* again to *Diopsis*. Descamps (1957) placed *Diopsis dubia* Bigot, 1874 by mistake in *Teleopsis*, but Shillito (1971a) and Steyskal (1972) referred it to *Diasemopsis*. Senior-White (1922) described *Teleopsis bipunctipennis* from Sri Lanka, but Steyskal (1975) referred it to *Pseudodiopsis* and subsequently Feijen (1989) placed it in *Sphyracephala*. Brunetti (1928c) described *Teleopsis latifascia* from Sierra Leone, but Shillito (1971a) rejected its placing in this genus. Feijen (1989) erected *Cobiopsis* for *latifascia*, a monotypic genus in the *Diasemopsis* group. In the UMO collection two undescribed species of Bigot are present: '*Diasemopsis fenestrata*' (as *fenestratus*) and '*Diasemopsis rufithorax*'. The latter species represents a *Cyrtodiopsis*, but the 'type-series' of *fenestrata* consists of two *Teleopsis* and one *Cyrtodiopsis*. Brunetti (1907) and Steyskal (1975) placed '*fenestrata*' nomen nudum in synonymy with *Teleopsis quadriguttata*, which was incorrect for the *Cyrtodiopsis* specimen, while the two *Teleopsis* might belong to a species of the *quadriguttata*-complex.

Diopsis neesii Westwood 1837b (origin 'Japoniâ?') could, judging from Westwood's description and figure, only have been a *Cyrtodiopsis* or a *Teleopsis*. As Westwood clearly mentioned the presence of two pairs of thoracic spines, the former possibility seems more likely. The type of *D. neesii* kept in the Bonn Zoological Museum was lost during the second world war.

Notes on some characters

Eye stalks (table 1). – In *Teleopsis* both dimorphic (males with relatively larger eye stalks) and homomorphic (average relative eye span in males and females about equal) species occur (Burkhardt & de la Motte 1985). Strongly dimorphic species in this respect are *T. belzebuth*, *motatrix*, *shillitoi* and *trichophora*, while *adjacens*, *breviscopium*, *discrepans*, *pharao*, *rubicunda*, *sykesii* and probably *onopyxus* are moderately dimorphic species. Weakly dimorphic species are *T. boettcheri*, *ferruginea* and *krombeini*, while *bigoti*, *quadriguttata*, *sexguttata* and probably *maculata* and *selecta* are homomorphic species. In table 1 data are presented on the ratio eye span/body length and the ratio length/width of the front femur for the 19 *Teleopsis*. A clear correlation appears between the degree of sexual dimorphism for these two characters. A more detailed analysis of this phenomenon will be presented in the last contribution to the *Teleopsis* monograph, when thirteen more species will have been described. The following categories are used for description of the eye span: *very small* for a ratio eye span/body length (E/B) ≥ 0.75 , *small* in case of $0.75 < \text{E/B} \leq 0.90$, *medium-sized* for $0.90 < \text{E/B} \leq 1.10$, *large* for $1.10 < \text{E/B} \leq 1.25$, *very large* for $1.25 < \text{E/B}$

1.50 and *extremely large* for $1.50 < \text{E/B}$.

Base of IVB. – A stalk-like base (cone) of the IVB occurs in *T. boettcheri*, *breviscopium*, *discrepans*, *motatrix*, *pharao*, *rubicunda*, *selecta* and *shillitoi*. In some species only a tiny bristle stands on this cone, but in *rubicunda* in which the cone is not very large, the bristle is well developed. A wart-like base or just an elevation of the stalk at the base occurs in *T. adjacens*, *bigoti*, *belzebuth*, *ferruginea*, *krombeini*, *maculata*, *onopyxus*, *quadriguttata*, *sexguttata*, *sykesii* and *trichophora*.

Facial teeth. – Rounded facial corners are present in *T. adjacens*, *bigoti*, *ferruginea*, *krombeini*, *maculata*, *quadriguttata*, *rubicunda*, *selecta*, *shillitoi* and *trichophora*. Facial teeth are present in *T. belzebuth*, *breviscopium*, *boettcheri* (very small), *discrepans*, *motatrix*, *onopyxus*, *pharao*, *sexguttata* and *sykesii*.

Face. – In species like *T. sexguttata* and *quadriguttata* the upper half of the face is strongly protruding, which, together with the facial sulcus, divides the face into four sections. On the other hand, in *T. ferruginea* frons and face are flat and smoothly rounded.

Colour. – Most species are reddish (ferrugineous) or dark brown to blackish. As some variation occurs in nature or due to conservation methods, care has to be taken with this character. The legs are usually reddish to brown. Dark species (blackish head and thorax) are *T. bigoti*, *discrepans*, *onopyxus*, *sexguttata*, *shillitoi*, and *sykesii*. Species with a dark thorax and red to brown head are *T. adjacens*, *motatrix*, *pharao*, *quadriguttata*, *selecta*, *shillitoi* and *trichophora*. Reddish to brown head and thorax occur in *T. boettcheri*, *belzebuth* and *rubicunda*. The easiest species to recognize by its colours is *T. ferruginea*, with its glossy black head, reddish legs, thorax and basal abdomen and black apical abdomen. The abdomen has a few lateral pollinose spots or transverse bands, which have to be examined under various angles before being described.

Wing. – The wing pattern appears a useful character for dividing *Teleopsis* in groups, but care has to be taken as some intraspecific variation might occur, while some patterns are sometimes quite indistinct. In most species the apex of the wing is infuscated, but in *T. selecta* and *sykesii* a distinctly dark apex occurs, while in *boettcheri* and *motatrix* the apex is clearly hyaline. In the two species with a dark apex *T. selecta* is easily recognized by its wholly black wing with hyaline base and six spots, while *sykesii* has a very dark preapical band, a weaker band in the middle and some brown around the anal cell. In *T. ferruginea* the whole wing is slightly infuscated with a dark preapical band and two hyaline spots at the wing margins proximally of the preapical band. In *T. discrepans*, *motatrix* and *shillitoi* there is a distinct preapical band, a vague narrow band in the middle (which sometimes reaches the costa) and a spot near the anal cell. In *T. belzebuth* a preapical band and a band in the middle

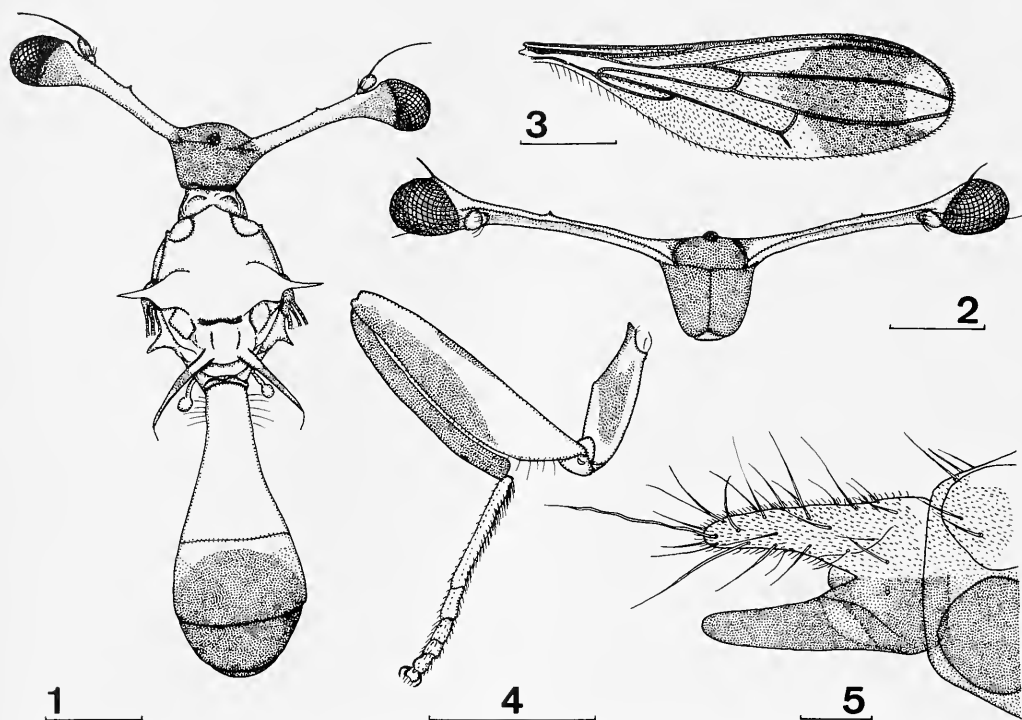


Fig. 1-5. *Teleopsis ferruginea*, Kandy, Udawattakele Sanct. – 1, ♀ habitus in dorsal view; 2, ♂ head in anterior view; 3, ♂ wing; 4, ♀ front leg, outer side; 5, dorsal view of ♀ terga 8 & 10 and cerci; fig. 1-4 scales 1 mm, fig. 5 scale 0.1 mm.

occur which are centrally connected (H-shape). In *T. bigoti*, *krombeini* sp. n. and (most?) *rubicunda* the same H-configuration occurs, but in addition a narrow basal band occurs. In *T. adjacens*, *boettcheri*, *trichophora* and (some?) *rubicunda* also an H-shape occurs but in the cross band a third hyaline spot occurs distally of the anterior crossvein. In *T. quadriguttata* three transverse bands occur, interconnected centrally so that four hyaline spots result (double H-shape). In *T. sexguttata* and *pharao* also a double H-shape occurs, but with, in addition, a small hyaline spot in the first posterior cell (if the pale apex is also included in the count of spots the six-spotted *sexguttata* is obtained). In *T. maculata* sp. n. from Sri Lanka a dark apex, a dark preapical band and two small dark spots in the middle of the wing occur.

Syntergum. – An unusual feature of *Teleopsis* is, that in all species the base of sternum 1 is fused to the syntergum. The degree of fusion varies. In *T. ferruginea*, for instance, the fusion includes the anterior half of the sternum, while externally no seam is visible. In other species a distinct seam is present.

Hairiness. – Most *Teleopsis* are rather bald, with

only a few scattered white hairs. Only *T. trichophora* and *boettcheri* have a more dense covering with large hairs, but these species are not as hairy as *Cyrtodiopsis dalmanni* (Wiedemann).

Front femora (table 1). – Intrageneric variation occurs in the ratio of length/width. It varies from very slender in the male of *T. belzebuth*, slender in the males of *motatrix*, *shillitoi*, *trichophora*, *breviscopium*, *discrepans* and *pharao*, moderately incrassate in males of *adjacens*, *rubicunda*, *sykesii*, *boettcheri*, *ferruginea*, *maculata* and *selecta*, to incrassate in males of *krombeini*, *bigoti*, *quadriguttata* and *sexguttata*. The following categories are used for description of the femur: *strongly incrassate* if the ratio length/width (L/W) is ≥ 3.0 , *incrassate* in case of $3.0 < L/W \leq 4.0$, *moderately incrassate* for $4.0 < L/W \leq 5.0$, *slender* for $5.0 < L/W \leq 6.5$, and *very slender* for $6.5 < L/W$. In a number of species sexual dimorphism occurs in the shape of the front femora. In *T. belzebuth*, *motatrix*, *shillitoi* and *trichophora* the females have more incrassate front femora and this can be described as strong dimorphism. This strong dimorphism in the shape of the front femora is correlated to the strong dimorphism in the eye span

(table 1). In *T. adjacens*, *breviscopium*, *discrepans*, *pharao*, *rubicunda*, *sykesii* and probably *onopyxus* the femora in the females are only somewhat more incrassate as in the males and this can be referred to as moderate dimorphy. In *T. boettcheri*, *ferruginea*, *krombeini*, *bigoti*, *quadriguttata*, *sexguttata* and probably *maculata* and *selecta* no differences between the sexes occur in the shape of the front femora.

KEY TO THE DIOPSIDS OF SRI LANKA

1. Arista tripartite; alula present; sixth vein extending beyond anal cell; syntergum only including terga 1 – 2, apical bristles several times longer than scutellar spines *Sphyracephala bipunctipennis*
- Arista bipartite; alula absent; sixth vein not extending beyond anal cell; syntergum including terga 1+2+3, apical bristles smaller than one-fourth the length of the scutellar spine or absent. (Diopsinae) 2
2. Supra-alar spines absent, scutellar spine almost straight, apical bristle absent, wing with only an apical wingspot *Diopsis* near *indica*
- Supra-alar spines present, scutellar spines strongly curved, apical bristles smaller than one-fourth the length of the scutellar spine, wing pattern otherwise (Teleopsis) 3
3. Central head glossy black, only one, preapical, wing band, front femora with dark spots 4
- Central head glossy brown, upper half of face more pronounced, thorax brown with posterior half of scutum glossy, three crossbands on the wing, front femora not with spots, dorsal abdomen yellowish brown basally and dark brown more apically, tergum 3 with two pale spots basally *Teleopsis krombeini* sp. n.
4. Frons and face flat and smoothly rounded, thorax (including collar) reddish, one very broad preapical crossband on the wing, dorsal abdomen brown with dark brown semicircular spot on apex *Teleopsis ferruginea*
- Upper half of face more pronounced, collar glossy black, scutum chestnut brown with black sutures, wing with two small dark spots in the middle and distinct apical spot, one narrow V-shaped preapical crossband on the wing, abdomen blackish brown with posterolateral pale spots on the first five terga *Teleopsis maculata* sp. n.

THE FERRUGINEA GROUP

All three known species originate from Sri Lanka. The group is especially characterized by the small articulate gonostyli without microtrichia but with hairs.

Furthermore, the *ferruginea* group is characterized by the absence of facial teeth, minute to small IVB, small base of IVB, medium-sized OVB, female spiracle 7 in membrane, divided male sternum 5, large and broad male cerci, weak sexual dimorphy in eye span and sexual homomorphy in front femora. The other groups presently recognized (*motatrix* group, *rubicunda* group, *sykesii* group, *boettcheri* group, *quadriguttata* group and *sexguttata* group) will later be characterized. Intrageneric phylogeny will be discussed in the final contribution to the monograph.

Teleopsis ferruginea (Röder, 1893) (figs. 1-11)

Diopsis ferruginea Röder, 1893: 235. Holotype ♀ South Sri Lanka (Ceylon), v.1889, H. Fruhstorfer (MLUH). [Examined]

?*Megalabops ferruginea*; Frey, 1928: 70.

Megalabops ferruginea; Shillito, 1940:157.

Teleopsis ferruginea; Steyskal, 1972: 11.

[Misidentification. – *Teleopsis ferruginea*; Curran, 1936: 2 (= *Cyrtodiopsis currani* Shillito, 1940)].

Further material. – 4♀, 6♂, Kandy, Udawattakele Sanct., Kan. Dist., Sri Lanka, 6-8.vi.1978, K. V. Krombein, P. B. Karunaratne, T. Wijesinhe, V. Kulasekare, L. Jayawickrema; 2♀, 3♂, Udawattakele Sanct., Kan. Dist., Sri Lanka, 8-11.ii.1979, K. V. Krombein, P. B. Karunaratne, T. Wijesinhe, S. Siriwardane, T. Gunawardane; 1♀, 3♂, Kandy Reservoir Jungle, Kan. Dist., Sri Lanka, 10.ii.1979, K. V. Krombein, P. B. Karunaratne, T. Wijesinhe, S. Siriwardane, T. Gunawardane; 3♀, 6♂, 1?, Udawattakele Sanct., Kan. Dist., Sri Lanka, 1-3.ix.1980, K.V. Krombein, P.B. Karunaratne, T. Wijesinhe, L. Jayawickrema, V. Gunawardane (all Krombein material in USNM, except for some specimens in CNMS and RMNH); 1♀, 1♂, Sri Lanka (BMNH); 5♂, Sri Lanka, Dr. Thwaites, 67-25 (BMNH); 2♀, 2♂, 3?, Sri Lanka, Weston Coll., BMNH 1924-199; 1♀, 2♂, Peradeniya, Sri Lanka, 30.iv.1891, Lt Col. Yerbury (BMNH); 2♂, Henaratgoda, Sri Lanka, i.1901 (BMNH); 1?, Suduganga, 10.ix.1919, R. Senior White (BMNH). In total 16♀, 30♂ and 5? were examined.

Description

Measurements. – length of body in ♀ 5.5 mm ± SE 0.2 (range 4.3-6.2) and in ♂ 5.8 mm ± 0.1 (range 4.7-6.2), eye span in ♀ 4.6 mm ± 0.2 (range 3.8-5.2) and in ♂ 5.9 mm ± 0.2 (range 4.0-7.4), length of wing in ♀ 4.3 mm ± 0.1 (range 3.4-4.8) and in ♂ 4.4 mm ± 0.1 (range 3.8- 5.1), length of scutellar spine in ♀ 1.16 mm ± 0.03 (range 0.99-1.30) and in ♂ 1.16 mm ± 0.02 (range 0.90-1.30).

Head. – Central part glossy black (figs. 1-2); ocellar tubercle glossy black; frons very smooth with laterally at base of stalk a deep groove (fig. 2); arcuate groove narrow and indistinct; face flat and smooth, laterally and ventrally with a typical 'woolly' type of pollinosity, some small white hairs, facial sulcus indistinct, facial corners rounded; mouthparts greyish brown; eye

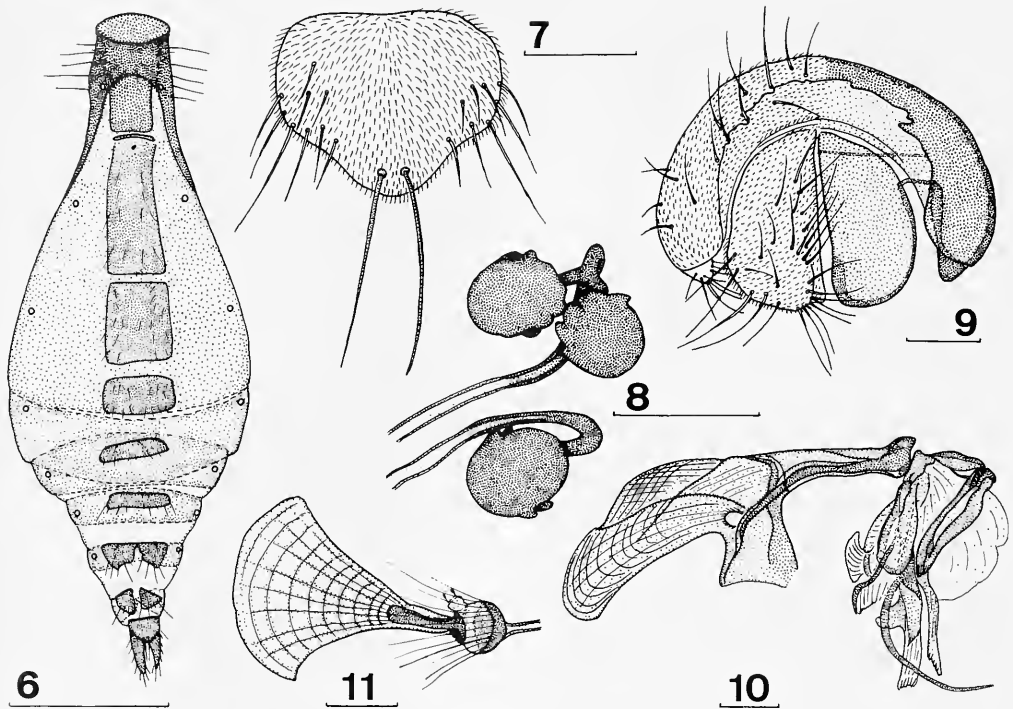


Fig. 6-11. *Teleopsis ferruginea*, Kandy, Udawattakele Sanct. – 6, ventral view of ♀ postabdomen; 7, ventral view of subanal plate; 8, spermathecae; 9, posterior view of perianthrium with gonostyli and cerci; 10, lateral view of phallapodeme and aedeagus; 11, ejaculatory apodeme and sac; fig. 6 scale 1 mm, fig. 7-11 scales 0.1 mm.

span small in female (eye span 16% smaller than length of body) and medium-sized in male (eye span 2% larger than length of body), stalks yellowish brown, anteriorly and posteriorly with a blackish band, apices blackish pollinose; ivb minute (almost invisible) and spinous, base of ivb a small elevation, one quarter the diameter of the eye stalk; ovb medium-sized, 2x the diameter of the eye stalk, spinous.

Thorax. – Uniformly reddish brown (ferruginous), anterior edge of collar black, laterally two black stripes on collar, prosternum with medial black spot between front legs, scutellar spines darker apically; dorsally thinly pollinose, anterior edge of collar densely pollinose, scutellar spines also pollinose but supra-alar spines glossy, upper half of pleura thinly pollinose, lower half glossy except for pollinose posterior area, sterna glossy but thinly pollinose anteriorly and near legs; supra-alar spines medium-sized, almost 3x as long as metapleural spines, laterally directed, somewhat turned upward; scutellar spines medium-sized, almost 3x scutellum, moderately curving upward and outward (fig. 1), diverging under an angle

of 80°; metapleural spines blunt, posterolaterally directed; apical bristle small, about one-sixth of length of scutellar spine; few small hairs on thorax, the hairs on the scutellar spines without basal warts.

Wing. – apex almost hyaline; very broad, very dark preapical band (fig. 3), apically convex, proximally concave and slightly extending in the first posterior cell; remainder of wing slightly infuscated but base hyaline, also hyaline spots in marginal and submarginal cell and basally in second posterior cell, both these hyaline spots adjoining the preapical band; glabrous basal area includes basal and posterior parts of costal cell, small basal section of marginal cell, basal half of first basal cell, most of second basal cell and posterior half of anal cell.

Legs. – Coxa 1 brown with blackish bands on inner and outer side, femur 1 brown with small dark spot basally on inner side, large black spots on distal two-thirds of outer side and some black dorsally (fig. 4), tibia 1 black, tarsi 1 yellowish white; mid leg brown with dark bands on femur and darker base of tibia; hind leg dark brown; femur 1 moderately incrassate

in ♀ and ♂, ratio of length/width in ♀ 4.5 ± 0.0 (range 4.4-4.8) and in ♂ also 4.5 ± 0.0 (range 4.2-5.0), tubercles on distal three-quarters, inner row in female with $25.7 \text{ tubercles} \pm \text{SE } 0.6$ (range 22-30) and in male with $27.6 \text{ tubercles} \pm 0.4$ (range 24-31), outer row in female with $21.9 \text{ tubercles} \pm 0.4$ (range 19-25) and in male with $22.6 \text{ tubercles} \pm 0.4$ (range 19-26); legs covered with some hairs, ventral side of front femur densely covered with small hairs.

Preabdomen. – Syntergum dorsally yellowish brown basally, apex with semi-circular dark brown spot (fig. 1), tergum 4 dark brown except for lateral edges proximally, other terga dark, dark areas of terga together forming a circle which coincides with the dark preapical wingbands (with wings in folded position); two basal terga thinly pollinose except for two pairs of glossy lateral spots, tergum 3 basally with two large pollinose spots laterally; dark apical terga pollinose; sterna yellowish brown, sternum 1 glossy; seam between terga 2 and 3 indistinct; basal half of sternum 1 smoothly fused to syntergum (fig. 6), intersternite 1-2 very short, other sterna located medially; spiracle 1 in sclerite (fig. 6).

Female postabdomen. – Strongly deflexed; terga 6 and 7 single rectangular sclerites (fig. 6); tergum 8 consisting of two sclerites (fig. 5), sclerites anteriorly glabrous; tergum 10 ill-defined, with one pair of hairs; cerci rather elongate, ratio of length/width 3.6, covered with microtrichia and with a number of hairs; sternum 6 a single rectangular sclerite; sternum 7 posteriorly constricted medially, giving two sclerites joined anteriorly; spiracle 7 in membrane; sternum 8 represented by two triangular sclerites; subanal plate (fig. 7) pentagonal with rounded corners, at apex a pair of large hairs; laterally some small hairs, covered with microtrichia; spermathecae (fig. 8) rounded with few rounded protuberances, ten in the single theca and eight each in the pair, heavily sclerotized; genital ring tapering towards one side.

Male postabdomen. – Sternum 4 a single rectangular sclerite; sternum 5 consisting of two small sclerites; sternum 7+8 without sclerotized connection to anterior sclerites of perianthrium; spiracle 7 in sternum 7+8; perianthrium (fig. 9) rounded, with about 14 pairs of hairs, covered with microtrichia; gonostyli articulated, remarkably small, apically rounded, a few hairs, no microtrichia, gonostyli connected to lateral side of cerci, not interconnected; cerci large, broad, flat, somewhat rectangular with rounded corners, ratio of length/width 1.9, covered with microtrichia and hairs; phallapodeme (fig. 10) with broad anterior arm, abruptly narrowing anteriorly and strongly curving downward, anterior arm slightly longer than posterior arm; aedeagus (fig. 10) with rather long ejaculatory duct sticking out from apex; ejaculatory apodeme fan-shaped (fig. 11), ejaculatory sac relatively small. The

interpretation of the ejaculatory duct as sticking out from the apex needs confirmation, as Kotrba (1993) states for *Cyrtodiopsis* that the ejaculatory duct opens in a phallotreme at the base of a long process.

Diagnosis

Teleopsis ferruginea gives its name to the *ferruginea* group. It is the most colourful of all diopsids with its glossy black head, reddish legs, reddish thorax and basal abdomen and black apical abdomen. Furthermore it can be recognized by its wing pattern (one broad preapical crossband), distribution of microtrichia on the wing (small glabrous area), minute ivb, medium-sized ovb, small base of ivb, absence of facial teeth, moderately incrassate front femora, rectangular female sternum 6, almost completely divided female sternum 7, female spiracle 7 in membrane, rounded pentagonal subanal plate, rather elongate female cerci, round spermathecae with 8-10 rounded protuberances, articulated and very small gonostyli without microtrichia and with few hairs, large and broad male cerci, anteriorly curved phallapodeme with longer anterior arm, fan-shaped ejaculatory apodeme, weak sexual dimorphism in eye span and sexual homomorphy in front femora.

Habitat

The two Kandy locations are jungle areas at an altitude of 550-650 m and have an average annual rainfall of 1950 mm.

Teleopsis krombeini sp. n.

(figs. 12-23)

Type material. – ♂ holotype, 4 ♀, 6 ♂ and 2? paratypes from Thawalamtenne, Kan. Dist., 2200 ft, Sri Lanka, 4.ix.1980, K. V. Krombein, P. B. Karunaratne, T. Wyessinhe, L. Jayawickrema, V. Gunawardane (USNM). 1 ♀ paratype from Kitugala, Bandarakele Jungle, Keg. Dist., Sri Lanka, 17-18.iii.1979, K. V. Krombein, P. B. Karunaratne, T. Wyessinhe, L. Jayawickrema, V. Gunawardane (USNM); 3 ♀ paratypes, Kandy, Sri Lanka, 28.v.1892, Lt Col. Yerbury (two with *rubicunda* label, det. J. A. Tenorio) (BMNH); 2 ♂ paratypes, Haragam, Sri Lanka, 24.v.1892, Lt Col. Yerbury (BMNH); 1 ♂ (BMNH genitalia slide), Kandy, Sri Lanka, 24.v.1892, Lt Col. Yerbury; 1 ♀ (BMNH genitalia slide), Haragam, Sri Lanka, 1.vi.1892, Lt Col. Yerbury (both slides were identified as *rubicunda* by J. Smart). Some paratypes are deposited in RMNH and CNMS. In total 9 ♀, 9 ♂ and 2? were examined.

Description

Measurements. – Length of body in ♀ $5.7 \text{ mm} \pm \text{SE } 0.2$ (range 5.2-6.2) and in ♂ $5.8 \text{ mm} \pm 0.2$ (range 4.9-6.4), eye span in ♀ $4.6 \text{ mm} \pm 0.1$ (range 4.0-5.1)

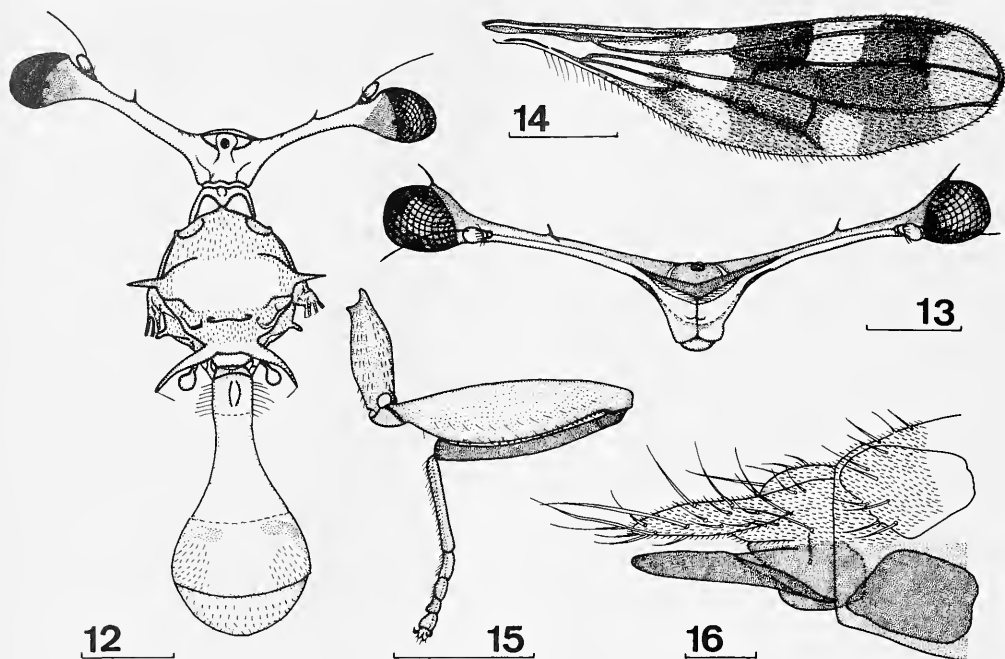


Fig. 12-16. *Teleopsis krombeini* – 12, ♀ paratype, Kitugala, habitus in dorsal view; 13, ♂ holotype, Thawalamtenne, head in anterior view; 14-15, ♂ paratype, Thawalamtenne; 14, wing; 15, front leg, outer side; 16, ♀ paratype, Thawalamtenne, lateral view of abdomen; fig. 12-15 scales 1 mm, fig. 16 scale 0.1 mm.

and in ♂ $5.8 \text{ mm} \pm 0.4$ (range 4.2-6.8), length of wing in ♀ $4.2 \text{ mm} \pm 0.1$ (range 3.8-4.6) and in ♂ $4.3 \text{ mm} \pm 0.1$ (range 3.6-4.7), length of scutellar spine in ♀ $1.16 \text{ mm} \pm 0.04$ (range 1.02-1.30) and in ♂ $1.12 \text{ mm} \pm 0.04$ (range 0.90-1.24).

Head. – Central part glossy brown, concolorous with stalks (fig. 12), laterally some pollinosity; frons smooth, slightly concave, with laterally at base of stalk a groove (fig. 13); arcuate groove dark brown, broad, area along arcuate groove with small transverse grooves; upper half of face more pronounced, face with ridge parallel to and just below arcuate groove, centrally two small protuberances, facial corners rounded; eye span small in female (eye span 19% smaller than length of body) and medium-sized in male (eye span just as long as length of body), stalks glossy brown, apices black pollinose; ivb rather small, spinous, equal in size to diameter of eye stalk, ivb on small tubercle with a length of less than half the diameter of the stalk; ovb medium-sized, slightly longer than ivb, spinous.

Thorax. – Uniformly brown; collar dorsally glossy, laterally pollinose; scutum thinly pollinose dorsally, but posterior half glossy; scutellum pollinose, scutel-

lar spines dark, glossy; pleura glossy but pollinose near base of wing and posteriorly; sterna glossy with some pollinosity between front legs; supra-alar spines medium-sized, twice as long as metapleural spines, laterally and somewhat upward directed; scutellar spines long, more than $3.5\times$ scutellum, strongly curving upward and outward (fig. 12), diverging under an angle of 90° ; metapleural spines blunt, posterolaterally directed; apical bristle small, about one-fifth of length of scutellar spine, medially directed (lacking in most specimens); few, small hairs on thorax, hairs on scutellar spines without basal warts.

Wing. – Apex infuscated; three crossbands, broad preapical dark band and broad central dark band joined in first posterior cell, forming H-configuration (fig. 14), anterior part of preapical band and part in first posterior cell darker, some parts of central band darker; narrow, vaguely infuscated, basal band running from tip of costal cell to tip of anal cell, region below anal cell infuscated with darker central smudge; the pattern of bands leaves a hyaline base, adjoining hyaline spots in submarginal, marginal and discal cell, a hyaline spot centrally in the third posterior cell, a hyaline spot in submarginal and marginal

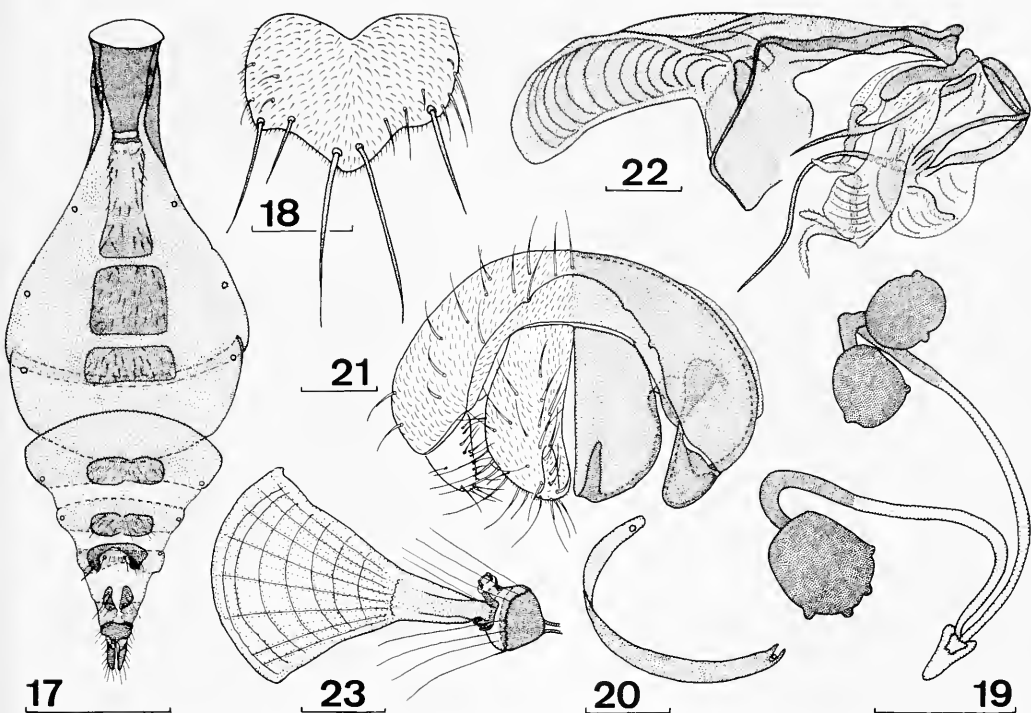


Fig. 17-23. *Teleopsis krombeini* paratypes, Thawalamtenne – 17, ventral view of ♀ postabdomen; 18, ventral view of subanal plate; 19, spermathecae; 20, ♂ sternum 7+8; 21, posterior view of perianthrium with gonostyli and cerci; 22, lateral view of phallapodeme and aedeagus; 23, ejaculatory apodeme and sac; fig. 17 scale 1 mm, fig. 20 scale 0.2 mm, all others scales 0.1 mm.

cell and a hyaline spot basally in second posterior cell; the glabrous basal area includes the costal cell, base of submarginal cell, basal halves of first and second basal cell and almost the whole anal cell; the adjoining hyaline spots in submarginal, marginal and discal cells are also glabrous.

Legs. – Coxa 1 brown, femur 1 brown with darker inner side, tibia 1 blackish brown, tarsi 1 brown; mid and hind legs brown, apical quarter of femora darker, basal half of mid tibia and whole of hind tibia blackish brown; femur 1 incrassate (fig. 15) in both sexes, ratio of length/width $3.8 \pm \text{SE } 0.1$ in ♀ (range 3.4-4.2) and 3.9 ± 0.1 in ♂ (range 3.6-4.1), tubercles on distal three-quarters, inner row in female with 26.8 tubercles $\pm \text{SE } 0.7$ (range 23-30) and in male with 28.0 tubercles ± 0.6 (range 23-31), outer row in female with 23.4 tubercles ± 0.5 (range 20-26) and in male with 24.9 tubercles ± 0.4 (range 22-27); legs covered with some hairs.

Preabdomen. – Tergum 1 and 2 glossy yellowish brown with two transverse darker bands in the middle; tergum 3 and subsequent terga dark brown,

glossy (some very thin pollinosity), tergum 3 with two pale spots basally, covered with white pollinosity, white pollinosity extending laterally (fig. 12); sterna yellowish brown, sternum 1 glossy; seam between terga 2 and 3 not very distinct; basal half of sternum 1 smoothly fused to syntergum (fig. 17), intersternite 1-2 narrow, other sterna located medially; spiracle 1 in sclerite (fig. 17).

Female postabdomen. – Strongly deflexed; terga 6 and 7 single rectangular sclerites (fig. 17), tergum 7 concave posteriorly; tergum 8 represented by two sclerites (fig. 16), sclerites anteriorly glabrous; tergum 10 with one pair of hairs; cerci very elongate, ratio of length/width 5.4, covered with microtrichia and with a number of hairs; sterna 5 and 6 rectangular sclerites; sternum 7 more or less U-shaped, the central-posterior region not being sclerotized; spiracle 7 in membrane; sternum 8 represented by two small sclerites; subanal plate (fig. 18) in between pentagonal and heart-shaped, with posteriorly two pairs of long hairs and about five pairs of short hairs, covered with microtrichia; spermathecae (fig. 19) rounded with sub-

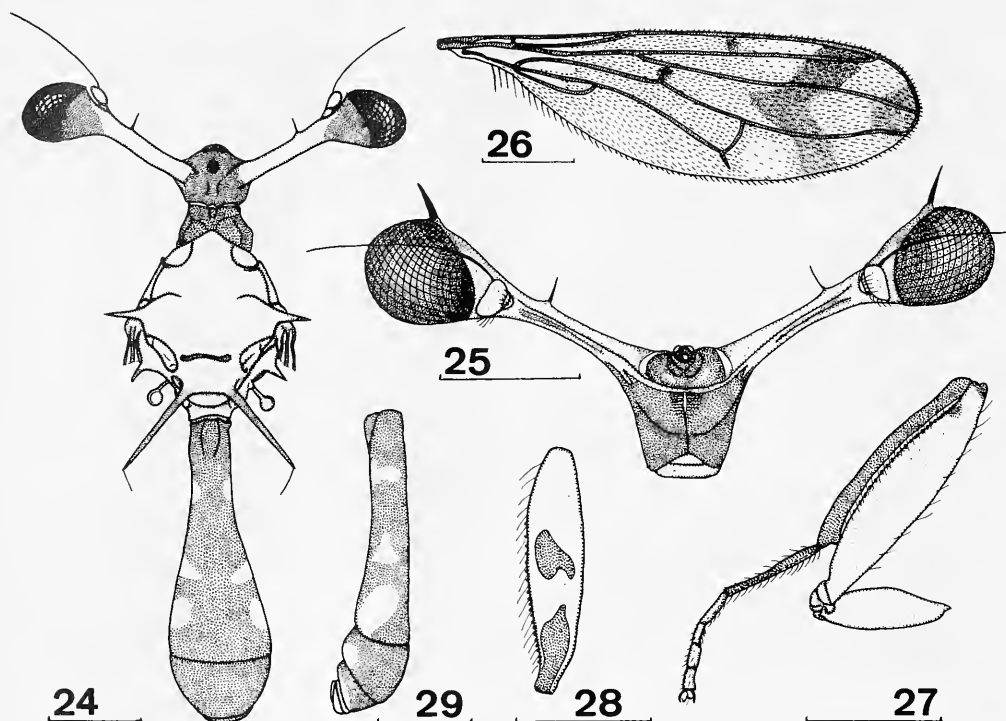


Fig. 24-29. *Teleopsis maculata* ♂ holotype, Nuwara Eliya – 24, habitus in dorsal view; 25, head in anterior view; 26, wing; 27, front leg, outer side; 28, front femur, inner side; 29, lateral view of abdomen; scales 1 mm.

apically a few rounded protuberances (four in the single theca and two each in the pair), heavily sclerotized.

Male postabdomen. – Sternum 4 a single rectangular sclerite; sternum 5 represented by two square sclerites; sternum 7+8 without sclerotized connection to anterior sclerites of perianthrium; left spiracle 7 in sternum 7+8, right spiracle 8 in lateral slit of sternum 7+8 (fig. 20); perianthrium (fig. 21) rounded, with about 13 pairs of rather short hairs, covered with microtrichia; gonostyli small, articulated, apically somewhat pointed, hairs mainly on inner side, no microtrichia, gonostyli connected to lateral side of cerci, not interconnected; cerci large, rather broad, flat, somewhat rectangular with rounded corners, ratio of length/width 2.2, covered with microtrichia and hairs, medial-posterior corners with narrow, darkly sclerotized, region; phallapodeme (fig. 22) with broad, rather straight anterior arm about equal in length to posterior arm, vane broad; aedeagus (fig. 22) with rather long ejaculatory duct sticking out from apex; ejaculatory apodeme fan-shaped (fig. 23), ejaculatory sac relatively small.

Diagnosis

Teleopsis krombeini belongs to the *ferruginea* group and can be recognized by its wing pattern (three cross-bands), distribution of microtrichia on the wing (glabrous basal area and basal anterior spot), small rvb, medium-sized ovb, small base of rvb, absence of facial teeth, incrassate front femora, glossy posterior half of scutum, rectangular female sternum 6, U-shaped female sternum 7, female spiracle 7 in membrane, pentagonal to heart-shaped subanal plate, very elongate female cerci, round spermathecae with 2-4 protuberances, small and articulated gonostyli without microtrichia, large and broad male cerci, phallapodeme with straight anterior arm equal in length to posterior arm, fan-shaped ejaculatory apodeme, weak sexual dimorphism in eye span and homomorphy in front femora.

Habitat

The Thawalamtenne location is a jungle area at an altitude of about 600 m and with an average annual rainfall of 1750 mm.

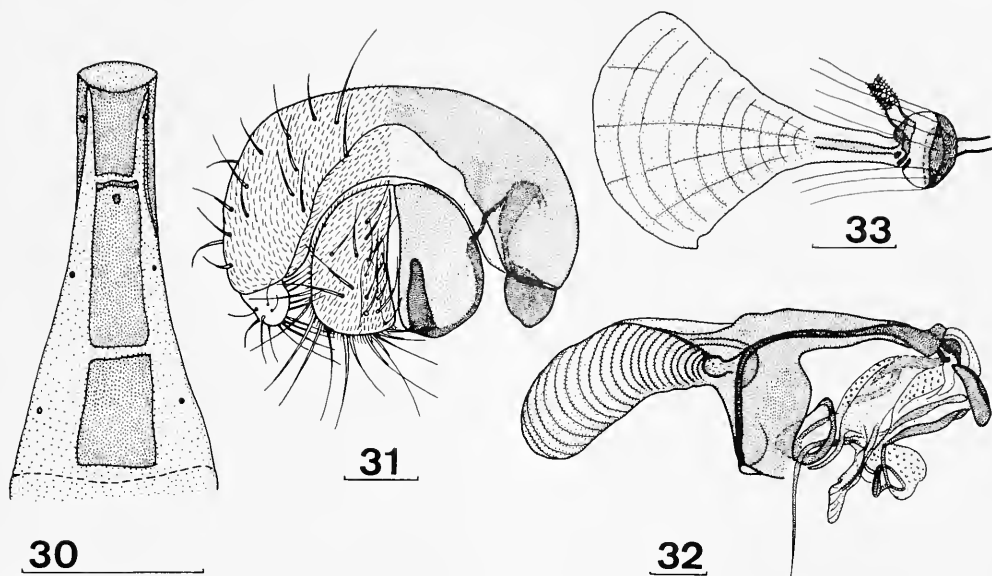


Fig. 30-33. *Teleopsis maculata* ♂ paratype, Hakgala Natural Reserve – 30, ventral view of basal abdomen; 31, posterior view of perianthrium with gonostyli and cerci; 32, lateral view of phallapodeme and aedeagus; 33, ejaculatory apodeme and sac; fig. 30 scale 1 mm, fig. 31-33 scales 0.1 mm.

Teleopsis maculata sp. n.
(figs. 24-33)

Type material. – ♂ holotype, Nuwara Eliya, Sri Lanka, 14.vii.1892, Lt Col. Yerbury, (BMNH); ♂ paratype from Hakgala Natural Reserve, N.E. Dist., Sri Lanka, 6-7.ii.1979, K. V. Krombein, P. B. Karunaratne, T. Wijesinha, S. Siriwardane, T. Gunawardane (USNM); 1? paratype (no head and abdomen), Punda luoya (Pundaloya), Sri Lanka, E. E. Green, BMNH 90- 115.

Description

Measurements. – Length of body in ♂ 5.8 mm (range 5.6-5.9), eye span 3.7 mm (range 3.4-3.9), length of wing 4.7 mm (range 4.2-5.2), length of scutellar spine 1.14 mm (range 1.12-1.15).

Head. – Central part glossy black (figs. 24-25); frons with medial depression below ocellar tubercle, bordered by two elevated areas, frons laterally surrounded by circular groove, two slightly paler spots above arcuate groove (fig. 25), anterolaterally roughened areas; arcuate groove dark, rather deep and narrow with roughened surface; face glossy black, dorsally around facial sulcus fine grooves, upper half more pronounced, facial corners rounded; eye span very small in male (eye span 37% smaller than length of body), stalks yellowish brown, dark stripes anteriorly on ventral part, broad apices black pollinose; rvb small, just longer than

diameter of eye stalk, on vague elevation of about one quarter the length of the diameter of the stalk; ovb medium-sized, $1\frac{1}{2}x$ the length of the rvb, spinous.

Thorax. – Collar glossy black, laterally some pollinosity; scutum chestnut brown with blackish sutures, posteriorly darker, thinly pollinose; scutellum brown, thinly pollinose, scutellar spines darker, glossy; mesopleuron and sternopleuron blackish brown anteriorly, remainder of pleura brown, near abdomen and in sutures blackish, pleura pollinose but most of sternopleuron, central part of mesopleuron and central part of hypopleuron glossy; sterna glossy but pollinose anteriorly and posteriorly; supra-alar spines medium-sized, slightly more than twice the length of the metapleural spine, laterally directed, slightly turned upward; scutellar spines long, almost $3.5x$ scutellum, rather straight, pointing upward and outward (fig. 24), diverging under an angle of 80° ; metapleural spines posterolaterally directed; apical bristle small, about one-fourth of length of scutellar spine, slightly turned inward; few, small hairs on thorax, small hairs along scutellar spines on tiny warts.

Wing. – Distinct apical wingspot in submarginal and first and second posterior cell (fig. 26); dark preapical band, somewhat V-shaped; tiny dark spots in the middle of the marginal cell and around the anterior crossvein; remainder of wing lightly infuscated with two pale spots proximally of the preapical band near the wing margins; the small glabrous basal area

includes most of the costal cell, base of submarginal cell, basal halves of first and second basal cell and basal half of anal cell.

Legs. – Coxa 1, trochanter 1 and femur 1 yellowish, femur 1 (figs. 27–28) with two brown spots on inner side, tibia 1 and metatarsus 1 dark brown, remainder of tarsus 1 paler (fig. 27); mid leg yellowish brown, femur 2 with dark spots on inner and outer side in the middle and dark apical third, basal half of tibia 2 slightly darker; hind leg yellowish brown, femur 3 with long dark spots on inner and outer side in the middle and dark apical quarter, tibia 3 mainly dark brown with pale brown band in the middle; femur 1 moderately incrassate in ♂, ratio of length/width 4.9 ± 0.0 , range 4.9–5.0, tubercles on distal three-quarters, inner row in ♂ with 28.0 ± 0.4 tubercles (range 27–29), outer row with 25.0 ± 0.4 tubercles (range 24–26).

Praedomen. – Terga blackish brown with posterolaterally pale spots on terga 1, 2, 3, 4 and 5 (figs. 24, 29), pollinose except for glossy basal half of tergum 2 and glossy basal band of tergum 3, pale spots on tergum 3 covered with dense pollinosity; sterna yellowish brown, sternum 1 glossy; seam between terga 2 and 3 almost invisible; basal edge of sternum 1 linked to syntergum (fig. 30), intersternite 1–2 narrow, other sterna located medially; spiracle 1 in tergum (fig. 30).

Male postabdomen. – Tergum 6 with anterior concavity medially; sternum 4 a single rectangular sclerite; sternum 5 represented by two sclerites; sternum 7+8 without sclerotized connection to anterior sclerites of perianthrium; left spiracle 7 in sternum 7+8, right spiracle 8 just in membrane; perianthrium (fig. 31) rounded, with about 15 pairs of hairs, covered with microtrichia; gonostyli small, articulated, apically blunt, hairs distributed along the sides, especially long hairs on inner side, no microtrichia, gonostyli connected to lateral side of cerci, not interconnected; cerci medium-sized, broad, flat, rectangular, ratio of length/width 2.0, covered with microtrichia and hairs, apical hairs long, medial-posterior corners with darkly sclerotized area; phallapodeme (fig. 32) anteriorly curved downward, anterior arm broad and somewhat longer than posterior arm, aedeagus (fig. 32) with rather long ejaculatory duct sticking out from apex; ejaculatory apodeme fan-shaped (fig. 33), ejaculatory sac small.

Diagnosis

Teleopsis maculata belongs to the *ferruginea* group and can be recognized by its wing pattern (apical spot and one V-shaped crossband), distribution of microtrichia on the wing (small glabrous area), small ivb, medium-sized ovb, small base of ivb, absence of facial teeth, glossy black central head and collar, moderately incrassate front femora with two spots on inner side, abdomen with five pairs of lateral spots, small

and articulated gonostyli without microtrichia and with long hairs on inner side, broad male cerci, anteriorly curved phallapodeme with anterior arm slightly longer than posterior arm, fan-shaped ejaculatory apodeme and probably minor sexual dimorphism in eye span and sexual homomorphy in front femora.

Habitat

The average annual rainfall at Nuwara Eliya, several miles away from the montane rain forest on Mount Hakgala, is 2160 mm.

ACKNOWLEDGEMENTS

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many species can be identified. Unfortunately the key in both the German and French edition is the same as in the previous edition, with the German species only and therefore cannot be used in more southern regions. The German version can be used to the northern border of the Mediterranean, including eastern France, northern Italy, Slovenia and northern Croatia. The French edition contains most continental French species, but again lacks several of the more eastern species, included in the German edition. So to be 'complete', it is necessary to buy both versions. The 'new' photographs in the French edition are not as good as the original ones, but it contains a lot of extra information on the French Fauna. Both guides contain brief descriptions of sound and some oscillograms.

The Dutch book [now almost sold out] is not a field-guide, it is too heavy, but more a distribution atlas with extensive information on all 45 Dutch species and some information on 19 species from neighbouring countries or exotic introduced species. Apart from the Dutch maps, the book contains European distribution maps, graphs on phenology and biotopes, and descriptions of sound with oscillograms. Also all species are illustrated with an artists impression of the

species and a colour photograph. It contains also an illustrated key of about 55 western European species.

The three CD's all have a smaller number of species than those of Ragge & Reynolds, but those of Bonnet and Odé have a much better sound quality because they are based on digital recordings. Bonnet's recordings have a nice sound, because they often are made in nature, and also background sounds can be heard such as those from birds, frogs, and other orthopterans. The CD by Odé has relatively long fragments, and is the only one with a considerable amount of other sound elements than the calling songs. The German CD is a simple transmission of the earlier musicassette and treats the German species only.

In short all these CD's have their own right, which also holds for the books. For identification the Bellmann guides are indispensable, but for southern Europe still incomplete. With the Ragge & Reynolds CD's at least some of this area is covered. The real Orthopterist probably would like to have all these books, which make this interesting group one of the better known groups in northwestern Europe. Now it is waiting for field guides or identification books for southern parts of Europe, highly needed to replace the outdated books by Harz. I hope that there are some orthopterists who dare to take this challenge.

[Erik J. van Nieukerken]

A REVIEW OF THE ELIMAEINI OF WESTERN INDONESIA, MALAY PENINSULA AND THAILAND (ENSIFERA, TETTIGONIIDAE, PHANEROPTERINAE)

Ingrisch, S., 1998. A review of the Elimaeini of Western Indonesia, Malay Peninsula and Thailand (Ensifera, Tettigoniidae, Phaneropterinae). – Tijdschrift voor Entomologie 141: 65-108, figs. 1-174, maps 1-3. [ISSN 0040-7496]. Published 30 November 1998.

A review of the Elimaeini occurring in Western Indonesia, Malay Peninsula, Thailand and adjacent islands is given. The stridulatory file on the underside of the male left tegmen, conchate phallus sclerites and modifications of the gonangulum of the ovipositor are introduced as new diagnostic characters. The phylogenetic relations of the genera and subgenera are discussed. *Hemielimaea* Brunner, 1878 is reduced to a subgenus of *Elimaea* Stål, 1874. *Phaneroptera parumpunctata* Serville, 1839 is designated as type species of *Rhaebelimaea*. In the subgenus *Elimaea*, there are two distinct species groups differing by the width of the tegmen which is (a) wider than the pronotal length (*Elimaea* s. str.) or (b) narrower than the pronotal length in males and of subequal width in females (*E. poaeifolia*-group). A tabular key to the species in the area considered is provided; the diagnostic characters are figured. Nine species are described as new: *Elimaea* (*Rhaebelimaea*) *mentaweei* sp. n., *E. (R.) marinjauensis* sp. n., *E. (R.) modiglianii* sp. n., *E. (R.) pseudochloris* sp. n., *E. (R.) sinuata* sp. n., *E. (R.) apicata* sp. n., *E. (R.) pentaspina* sp. n., *Elimaea* (*Elimaea*) *thaii* sp. n., *E. (Elimaea) nautica* sp. n.. Two species of the *E. poaeifolia*-group which are only known from single females, are informally described but not named. *Elimaea minor* (Brunner, 1891), formerly included in *E. (Rhaebelimaea)*, is transferred to *E. (Orthelimaea)*, *comb. n.*, *E. (R.) curvicerata* (Brunner, 1891) is removed from synonymy under *E. (R.) parumpunctata* (Serville, 1839). *Elimaea subcarinata* (Stål, 1861) is removed from synonymy under *E. chloris* (De Haan, 1842) and regarded a valid species with *E. appendiculata* Brunner, 1878 as a new synonym (the latter is not identical with *E. punctifera* (Walker, 1869)). *E. chloris* and especially *E. punctifera* have a much more restricted distribution than previously thought. The female of *E. (Hemielimaea) procera* (Ingrisch, 1990), and the male of *E. (H.) cucullata* (Ingrisch, 1990) are described for the first time. Information on stridulation of *Ectadia fulva* Brunner, 1893, *Elimaea* (*E. chloris*, *E. (E.) subcarinata*, *E. (E.) thaii* and *E. (H.) cucullata* is given.

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Key words. – Elimaeini, Phaneropterinae, South East Asia, phylogeny, key to species, taxonomy, new species, stridulation

The Phaneropterinae were divided into several groups by Brunner (1878) and these may be regarded as tribes in present day taxonomy (e.g. Bei-Bienko 1965). The tribe Elimaeini Yakobson, 1905 (group Elimaeae Brunner, 1878) consists so far of only three genera, *Elimaea* Stål, 1874, *Hemielimaea* Brunner, 1878, and *Ectadia* Brunner, 1878, all occurring in the Oriental region. It is thought to be most closely related with the African and Mediterranean Acrometopini and the Oriental Mirolliini (Brunner 1878).

The genus most rich in species, *Elimaea* Stål, 1874, contains a few widespread and numerous local species (Brunner 1878, 1891, Kirby 1906, Hebard 1922a, Karny 1926a-c, 1931, Tinkham 1943, Bei-Bienko 1951, 1962, 1965, Ingrisch 1990a, Jin & Xia 1994).

It was divided into three subgenera by Karny (1926a): *Orthelimaea*, *Rhaebelimaea*, and *Elimaea* s. str. While the anterior femur is straight in *Orthelimaea*, it is curved in *Elimaea* and *Rhaebelimaea*. The latter subgenera differ in the radius sector branching before or about in the middle of the tegmen. *Hemielimaea* differs from *Elimaea* by the tibial tympanum which is open on external and covered by a conchate fold on internal side, while in *Elimaea* it is covered by a conchate fold of the integument on both sides. *Hemielimaea* species are so far only known from China and Indochina, while the distribution of *Elimaea* s. lat. reaches from India to the Sunda Islands and the Philippines (map 1).

The species of the Elimaeini belong to the com-

mon Phaneropterinae in South East Asia. They can be found in primary forests as well as in secondary vegetation. They live in the lower vegetation as shrubs and grasses and are thus amongst the first katyids to be met when looking for Orthoptera in tropical Asia. Their activity is largely nocturnal. During day time they are often found sitting along the central vein of a leaf with the fore legs and antennae stretched anteriorly. In doing so, the head fits in the phasmid-like curvature of the anterior femora which is found in some of the taxa. The middle and the hind legs are pressed together and spread in an acute angle from the body (figs. 152-153, 155).

The great species diversity of *Elimaea* in South East Asia was noted by Hebard (1922a) and Karny (1926a). Despite this, many species are not well described, and it is difficult to identify *Elimaea* species without re-examining the types or specimens from the type localities. This is especially true for the species of the subgenus *Elimaea* s. str. which cannot be identified with certainty on the basis of the previously used characters. Thus it became necessary to find new differentiating characters. The characters that were most commonly used to identify *Elimaea* species are the tegminal venation (i.e. the branching of the radius sector), male and female subgenital plates, male cerci, and coloration. Coloration can, however, be greatly variable within species. The subgenital plates also show some individual variation (compare e.g. figs. 57 and 58) and, unfortunately, its shape in museum specimens may have changed due to desiccation after death (compare e.g. figs. 59 and 60).

Examination of material from the museums in Bogor (Indonesia), Leiden (The Netherlands) and Genoa (Italy) and my collection from Thailand, Sumatra and Java revealed two facts: (1) The number of species and the regional diversity is even greater than previously thought; and (2) there are additional distinctive characters that allow - together with those previously described - a clear distinction between the species in both sexes. Those characters are, in males: (1) the stridulatory file on the underside of the left tegmen, and (2) sclerotised structures of the phallus which consist of a pair of conchate (mussel-shaped) sclerites with serrate margin and sometimes with an additional unpaired sclerotised projection. Those sclerotised structures are characteristic for the species of *Rhaebelima* and *Hemielima*. In females, the gonangulum (a lateral sclerite at the base of the ovipositor) can be provided with an appendage of variable shape at the ventral margin. In some cases the corresponding area of the ventral ovipositor valves is also modified.

The purpose of the present paper is to show the distinctiveness of the new and previously recognised characters. This may be the basis for a future revision of the genus. The results are presented in form of a

tabular key to the species from Java, Sumatra, Mentawai Islands, Malay Peninsula and Thailand. The restriction to that area is for practical reasons, as no new material from other areas has been available to me. Especially the species from Vietnam and China cannot be revised without extensive new material as several of the types are lost (see checklist below). The present paper includes most of the species previously assigned to *Rhaebelima*, except those from Borneo and the Philippines, and it includes a redescription of the types of the "classical" species of *Elimaea* s. str. which were most difficult to differentiate and often wrongly identified.

The consideration of the new diagnostic characters makes it necessary to discuss the relations between the genera and subgenera anew on a phylogenetic basis. A checklist of the taxa of the *Elimaeini* is provided. Descriptions of species are restricted to new or insufficiently known species.

DEPOSITORIES

Material examined for this study is deposited in the following collections:

BMNH	The Natural History Museum, London, England
CI	Private collection of S. Ingrisch, Bad Karlshafen, Germany, will later be deposited in a museum
DAB	Department of Agriculture, Entomology and Zoology Division, Chatuchak, Bangkok, Thailand
MCSN	Museo Civico di Storia Naturale, Genoa, Italy
MZB	Museum Zoologicum Bogoriense, Bogor, Indonesia
NHMW	Naturhistorisches Museum, Vienna, Austria
MNHN	Museum National d'Histoire naturelle, Paris, France
RMNH	Nationaal Natuurhistorisch Museum, Leiden, The Netherlands
NRS	Naturhistoriska Riksmuseet, Stockholm, Sweden
SMF	Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt/M, Germany
ZSI	Zoological Survey of India, Calcutta, India.

METHODS FOR RECORDING STRIDULATION

Stridulation of one species each of *Ectadia*, *Hemielima* and *Rhaebelima* and that of three morphologically similar species of *Elimaea* s. str. were so far recorded. Recording of the song of *E. chloris* was done in the field, that of the other species in wooden cages with gauze walls in the laboratory. In Phaneropterinae, there is usually a male-female response stridulation (Heller 1990). With one exception, only the male songs which are more distinctive were studied. All recordings were

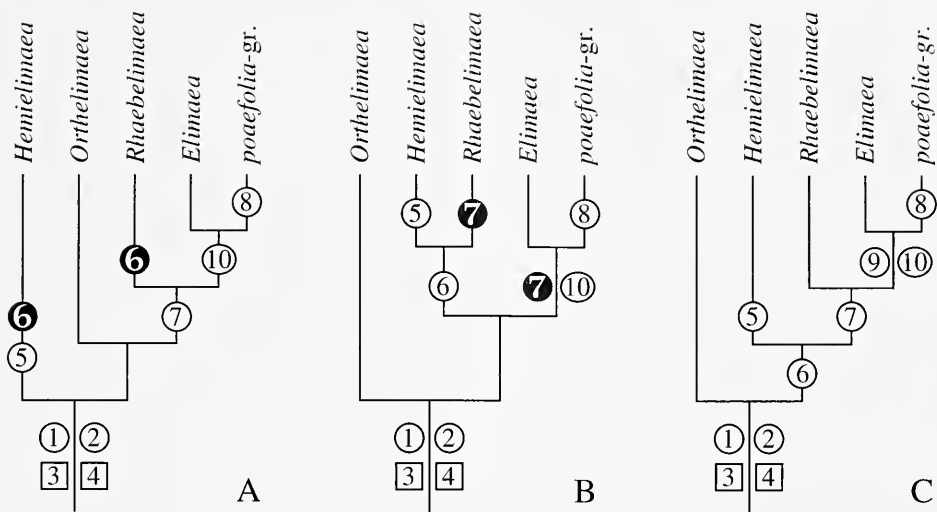


Fig. 1. Three hypothetical phylogenetic trees (A-C) of the Elimaeini without *Ectadia* as discussed in the text. Circles = apomorphic characters; squares = plesiomorphic characters; inverse numbers = apomorphic character must have evolved twice independently. Characters: 1, tegmen with parallel principle veins and strong, regular, vertical transverse veinlets; 2, gonangulum of ovipositor ventrally projecting or with appendage; 3, anterior femur straight; 4, tibial tympana conchate on both sides; 5, tibial tympana conchate on internal, open on external side; 6, phallus with a pair of conchate sclerites; 7, anterior femur curved; 8, tegmen very elongate (narrower than pronotum length in male); 9, phallus sclerites secondarily reduced; 10, radius sector branching in anterior quarter or third of tegmen.

made during the night in darkness. For recording in the field, a portable cassette recorder (Sony WM3) with a stereo microphone (Sennheiser MKE 66) and CrO₂-tape cassettes were used (frequency range 0.05 - 15 kHz), in the laboratory a cassette recorder (Kenwood KX 880 HX) with a mono microphone (AKG D202 or Sennheiser black fire 541) and metal tape cassettes (frequency range 0.05 - 20 kHz). Analysis of stridulation was done using the programme Soundscope on a Macintosh PC (Quadra 840) with a MacAdios II/16 board as A/D converter which was connected via a MacAdios ABO box to the cassette recorder. The sound was filtered before analysis (ZOLA-filter WLFDPAP). The oscillograms were copied into a graphic program for arrangement and final presentation.

PHYLOGENY

Within the Elimaeini, *Ectadia* is rather remote from the other genera and shows some similarities with the Acrometopini and the Mirolliini. The similarities of *Ectadia* with *Acrometopa* concern e.g. the rather stout and somewhat breakable antennae (but not as extreme as in *Acrometopa*) and the wing dimorphism of male and female (the wings of *Ectadia* females are however less reduced than those of *Acrome-*

topa females). The tegminal venation with an irregular course of the media and a wide network of oblique transverse veins resembles the situation in *Mirollia*. In the other Elimaeini, the antennae are thin and flexible, the tegmina of both sexes are of equal size, and the principle veins of the tegmen are straight, subparallel and rather equally spaced from each other with the transverse veins running vertical to the principle veins. The relations of *Ectadia* have to be re-evaluated in a suprageneric revision of the Phaneropterinae, which is beyond the scope of the present paper. Brunner (1891) assigned also the African genus *Pantolepta* Karsch, 1889 to the Elimaeini, because it has the fore and mid femora compressed and spined on ventral margins. It was said to be close to both *Acrometopa* and *Ectadia* Brunner (1891). The stout, breakable antennae and the reduced hind wings of the female, which do not surpass the tegmina, makes it more likely that *Pantolepta* belongs to the Acrometopini, but its position should also be re-evaluated in a suprageneric revision. The remaining taxa of the Elimaeini are certainly closely related to each other, and these should be considered, if the formal, present day division into genera and subgenera is correct, from a phylogenetic point of view.

A phylogenetic tree based on the presently recog-

nised division is presented in fig. 1a. The armature of the tibial tympana is obviously a character that is readily modified in the Phaneropterinae. It is conchate on both sides in the Acrometopini, in *Ectadia* and in *Elimaea*, and it is conchate on internal and open on external side in *Hemielimaea* and in the Mirolliini. As such there is not a very strong argument for a separation of *Hemielimaea* and *Elimaea*. Moreover, if we agree with the traditional arrangement of the genera, we have to suppose that the occurrence of a pair of conchate sclerites on the phallus has evolved twice independently in this closely related group of taxa (in *Hemielimaea* and in *Rhaebelimaea*). The phallus of the majority of Phaneropterinae is basically simply membranous. Sclerotised structures exist in several genera but they are not well known. Their structures probably evolved independently in different genera or genus groups. However, those of *Hemielimaea* and *Rhaebelimaea* species are very similar in shape and position and may thus be regarded as homologous structures of both taxa. In *Orthelimaea*, the phallus is membranous, but in some species the dorsal lobes are provided with a stiffened longitudinal ridge covered with spinules. A situation which is regarded more primitive than the possession of distinct sclerites as in *Hemielimaea* and *Rhaebelimaea*. Sclerotised structures are also found on the phallus of the Mirolliini, but these are quite different from those of the Elimaeini. They will be dealt with in a later paper.

If however, we regard *Hemielimaea* and *Rhaebelimaea* as sister groups on the base of the phallus sclerites as a synapomorphic character (fig. 1b), we have to suppose that the phasmid-like curvature of the anterior femora evolved twice independently in a closely related group of taxa (*Rhaebelimaea* and *Elimaea*). Curved anterior femora are unique in the Phaneropterinae and may thus be regarded as a synapomorphic character of *Rhaebelimaea* and *Elimaea*.

A solution would be a sister group relationship as presented in the third phylogenetic tree (fig. 1c). In this tree, both characters, phallus sclerites and curved anterior femora, are considered to be apomorphic and evolved only once within Elimaeini. But in contrast to the first tree (fig. 1a), it is supposed that the phallus sclerites are secondarily reduced in *Elimaea* s. str. The third tree is the most parsimonious, as we do not have to suppose that any obviously homologous characters evolved twice independently.

If we accept the phylogenetic tree in fig. 1c to be correct, the division of the Elimaeini into genera and subgenera has to be changed. There are two alternatives: (1) At least *Orthelimaea* has to be removed from *Elimaea* and raised to full generic rank, as it is more remote from *Elimaea* and *Rhaebelimaea* than is *Hemielimaea*. *Rhaebelimaea* might also be raised from a subgenus under *Elimaea* to full generic rank as it

shows close relations to both, *Hemielimaea* (conchate phallus sclerites) and *Elimaea* (curved anterior femora). (2) *Hemielimaea* should become a subgenus of *Elimaea*. As this is not a complete revision of the tribe, the second alternative is preferred.

The species previously included in the subgenus *Elimaea* can be divided into two distinct morphological groups, as already recognised by Karny (1926a): (1) species with moderately narrow tegmina which are distinctly wider than the pronotum length, and (2) species with very elongate tegmina which are in the male narrower than the pronotum length and in the female of subequal width. To the former belongs the type species (*Phanoptera subcarinata* Stål, 1861) of *Elimaea* and they are thus the *Elimaea* s. str. The latter are listed here as the *E. poaeifolia*-group within the subgenus *Elimaea*. As both are sister groups with many shared characters, they can remain in the same subgenus. If the males, which are unknown for several species of the *E. poaeifolia*-group, show constant differences to *Elimaea* s. str., it might later be useful to erect a separate subgenus for this group.

SYSTEMATIC PART

Checklist of the species of Elimaeini

With information on types, type localities and depositories. Abbreviations: H holotype, S Syntypes, F female, M male; synonyms marked by =.

Ectadia Brunner, 1878

fulva Brunner, 1893

HM: Burma: Carin Cheba (Genoa)

= *abbreviata* Brunner, 1893

HF: Burma: Carin Ghecu (Genoa), synonymy by Bei-Bienko (1954)

pilosa Brunner, 1878

HM: Kashmir (Vienna)

sulcata Xia & Liu, 1990

HM: Yunnan: Baoshan (Shanghai)

Elimaea (*Orthelimaea*) Karny, 1926

flavolineata Brunner, 1878

HM: Sri Lanka (Vienna)

himalayana Ingrisch, 1990b

HM: Nepal: Prov. Narayani, Bhainse Dobhan (Munich)

hunanensis Kang & Yang, 1992

HF: China: Hunan (Beijing)

insignis (Walker, 1869) (*Phanoptera*)

HM: Bangladesh: Silhet (London)

= *notabilis* (Walker, 1869) (*Phanoptera*)

HF: Bangladesh: Silhet (London), synonymy by Kirby (1906) and Uvarov (1927)

= *annulata* Brunner, 1878

SFM: "Hinter-Indien", Calcutta (Vienna; Budapest, lost), synonymy by Kirby (1906) and Uvarov (1927)

inversa Brunner, 1891

HM: Sulawesi (Warsaw? formerly coll. Dohrn, Stettin)

- klinghardti* Krausze, 1903c
HM: Tonkin (lost)
- leeuwenii* Karny, 1926a
SMM: Thailand: Bangkok (Bogor; Leiden)
- minor* Brunner, 1891
SMM: Java: Tengger mountains (Vienna)
- securigera* Brunner, 1878
SFM: East-India: Simla (Geneva)
- Elimaea (Hemielimaea)*** Brunner, 1893
- chinensis* (Brunner, 1878) (*Hemielimaea*)
SFM: China (Budapest, lost?; Vienna)
- cucullata* (Ingrisch, 1990a) (*Hemielimaea*)
HF: Thailand: Kanchanaburi prov., Erawan falls (Frankfurt/M)
- formosana* (Shiraki, 1930) (*Hemielimaea*)
SFM: Taiwan: Arisan Mt. (Ent. Mus. Govern. Res. Inst., Taiwan)
- mannhardti* Krausze, 1903a
HF: Tonkin: Than-Moi (lost), combined with *Hemielimaea* by Dohrn 1906
- procera* (Ingrisch, 1990a) (*Hemielimaea*)
HM: Thailand: Chanthaburi prov., Khao Soi Dao (Frankfurt/M)
- tonkinensis* (Dohrn, 1906) (*Hemielimaea*)
SFM: Tonkin: Than-Moi (Warsaw? formerly Stettin)
- Elimaea (Rhaebelimaea)*** Karny, 1926
- adpersa* Dohrn, 1906 (*Elimaea signata* var. *adpersa*)
SFM: Sumatra: not further specified, but Dohrn collected in North Sumatra (Warsaw? formerly Stettin)
- apicata* sp. n.
HM: Thailand: Surat Thani province, Khao Sok (Bangkok)
- bakeri* Hebard, 1922a
HM: Mindanao: Davao (Philadelphia)
- bidentata* Brunner, 1878
HF: Malabar (Berlin)
- brunneri* Dohrn, 1906
HF: Philippines (Vienna), replacement name for *E. parumpunctata* Brunner, 1878 nec Serville, 1839
- caricifolia* (De Haan, 1842) (*Phaneroptera*)
HM: Borneo: Loetontoer (Leiden)
- = *femorata* Brunner, 1878
HF: Borneo (Vienna), synonymy by Dohrn (1906) and Karny (1923)
- curvicerata* Brunner, 1891
SFM: Java orientalis (Vienna)
- filicauda* Hebard, 1922a
HM: Luzon: Laguna, Los Banos (Philadelphia)
- hebardei* Karny, 1926b
SFM: South Sumatra: Lampongs, Wai Lima (Bogor; Leiden)
- kraussi* Karny, 1926a
SFM: West Java, Cibodas, 1400m (Bogor; Leiden)
- lamellipes* Hebard, 1922a
HF: Sabah: Labuan (Philadelphia)
- longicercata* Brunner, 1891
SFM: Borneo (Vienna)
- malayica* Karny, 1920
SFM: Borneo (Vienna), replacement name for *E. poaeformis* Brunner, 1878 nec De Haan, 1842
- maninjauensis* sp. n.
HM: West Sumatra: Maninjau (Bogor)
- mentawei* sp. n.
HM: Mentawai Islands (Bogor)
- modiglianii* sp. n.
HM: Sumatra: Si-Rambe (Genoa)
- moultonii* Karny, 1923
HF: Sarawak: Baram river (Singapore?)
- neglecta* Karny, 1926c
HF: Malaysia: Selangor, Kanching (Kuala Lumpur)
- parumpunctata* (Serville, 1839) (*Phaneroptera*)
HF: Java (Paris)
- pentaspina* sp. n.
HF: Thailand: Chanthaburi prov., Khao Soi Dao (Bangkok)
- pseudochloris* sp. n.
HM: Thailand: Trang prov., Khao Chong (Bangkok)
- puncticosta* Bolivar, 1914
HF: ? Philippines or Himalaya (lost), occurs in the Philippines according to Karny (1926b)
- roseolata* Brunner, 1891
HF: Sumatra: Deli (Warsaw? formerly coll. Dohrn, Stettin)
- siamensis* Karny, 1926c (*Elimaea signata siamensis*)
HF: South Thailand: Nakhon Sri Tamarat (Kuala Lumpur)
- signata* Brunner, 1878
SFM: Singapore: Bukit (Vienna)
- sinuata* sp. n.
HM: Mentawai Islands: Sipora (Bogor)
- spinigera* Brunner, 1878
HM: Singapore: Bukit (Vienna)
- sumatrana* Karny, 1926a
HM: West Sumatra: Padangische Bovenland, Batu Sangkar (Philadelphia), replacement name for *E. parumpunctata* Hebard, 1922a nec Serville, 1839
- transversa* Ingrisch, 1990a
HF: Thailand: Chanthaburi prov., Khao Soi Dao (Frankfurt/M)
- willemsi* Karny, 1926b
HM: South Sumatra: Lampongs, Wai Lima (Leiden)
- The subgeneric position of the following species was not considered before. Judging from the descriptions, they might belong to *Rhaebelimaea*:
- melanocantha* (Walker, 1869) (*Phaneroptera*)
HM: Sri Lanka (London)
- = *carinata* Brunner, 1878
HF: Sri Lanka (Berlin), synonymy by Uvarov (1927)
- nigrosignata* Bolivar, 1900
SFM: South India: Madure, Kodaikanal (Madrid, Paris)
- verrucosa* Brunner, 1878
SFM: ? (Geneva)
- Elimaea (Elimaea)*** Stål, 1874
- annamensis* Hebard, 1922a
HM: Annam: Phuc-Son (Philadelphia)
- berezovskii* Bei-Bienko, 1951
HM: Sichuan: Lunfufu-Kuochikow (St. Petersburg)
- chloris* (De Haan, 1842) (*Phaneroptera*)
SFM: Java: Thihanjavar (Leiden)
- fallax* Bei-Bienko, 1951
HF: Southern Maritime Territory of USSR (St. Petersburg)
- hoozanensis* Karny, 1915
SFM: Taiwan: Hoozan (DEI Berlin-Dahlem)
- nautica* sp. n.
HM: Thailand: Chanthaburi prov., Khao Soi Dao (Bangkok)

- punctifera* (Walker, 1869) (*Phaneroptera*)
 HM: Bangladesh: Silhet (London)
 = *diversa* (Walker, 1869) (*Phaneroptera*)
 HF: Bangladesh: Silhet (London) synonymy by Uvarov (1927)
schmidtii Krausze, 1903a
 HM: Annam: Phuc-Son (lost)
semicirculata Kang & Yang, 1992
 HM: Fujian, Dehua (Beijing)
setifera Bei-Bienko, 1962
 HM: Yunnan (St. Petersburg)
subcarinata (Stål, 1861) (*Phaneroptera*)
 SFM: Hongkong (Stockholm)
 = *appendiculata* Brunner, 1878
 HM: Indochina (Vienna) synonymy in this paper
 = *rubicunda* Krausze, 1903a
 HM: Tonkin: Than-Moi (lost) synonymy by Dohrn (1906) as synonym of *E. appendiculata*
thaii sp. n.
 HM: Thailand, Tak prov.: Mae Salid, Monkrating, 700m (Bangkok)
tympnalis (Matsumura & Shiraki, 1908) (*Phaneroptera*)
 SMM: Taiwan (Matsumura's coll.)

The subgeneric position of the following species was not stated with the description nor later revised. Most of them probably belong to *Elimaea* s. str., but some might belong to other subgenera:

- atrata* Carl, 1914
 HM: Tonkin (Geneva)
cheni Kang & Yang, 1992
 HM: China: Hunan (Beijing)
lii Kang & Yang, 1992
 HM: China: Guangxi, Longgang (Beijing)
obtusilota Kang & Yang, 1992
 HM: China: Guangxi, Longzhou (Beijing)
schenklingi Karny, 1915
 SFM: Taiwan, Koshun (DEI Berlin-Dahlem)
lanceolata (Walker, 1859) (*Steirodon*)
 HF: Sri Lanka (London)
 = *rufonotata* Walker, 1869 nec Serville, 1839 (*Phaneroptera*) Sri Lanka (London) synonymy by Kirby 1906
macra (Serville, 1839) (*Phaneroptera*)
 HM: ? (Paris)
marmorata Brunner, 1878
 HF: Sumatra (Vienna), included in *Rhaebelima* by Karny (1926a), but judging from the shape of the tegmen, it might belong in the *E. poaeifolia*-group
nigerrima Krausze, 1903a
 HF: Tonkin: Than-Moi (lost)
parva Liu, 1993
 HM: China: Fujian, Mt. Longqi (Shanghai)
rufonotata (Serville, 1839) (*Phaneroptera*)
 HM: Bombay (Paris)
terminalis Liu, 1993
 HM: China: Fujian, Mt. Longqi (Shanghai)

Elimaea poaeifolia-group

- jacobsonii* Karny, 1926a
 HM: West Sumatra: Bukittinggi, Fort Kock (Leiden)
poaeifolia (De Haan, 1842)
 SFM: Java (Leiden)
rosea Brunner, 1878
 SFM: Borneo (Vienna; Dresden)

- sp. 1
 F: Thailand: Chiang Mai prov., Chiang Dao (Bangkok)
 sp. 2
 F: Thailand, Tak prov., Mae Salid, Monkrating, 700m (ci)

Species with uncertain status:

- aliena* (Walker, 1869) (*Phaneroptera*)
 HM: Bangladesh: Silhet (London), treated in Kirby (1906) as a synonym of *E. parumpunctata*; this is certainly wrong; if it belongs in *Elimaea*, it might belong to the *poaeifolia*-group
theopoldi Krausze, 1903b
 HF: Tonkin (lost), cited in Karny (1926a) as "species dubia".
triticifolia (De Haan, 1842) (*Phaneroptera*)
 HF: Borneo: Kahayan (Leiden), listed under *Elimaea* in Brunner (1878) and Kirby (1906); according to Karny (1926a) this is not an *Elimaea* species but might belong to ?*Habra*

Tentative key

This key is meant for the species of *Elimaeini* occurring in Java, Sumatra, Mentawai Islands, Malay Peninsula, Singapore and Thailand.

Although the key is largely based on material studied by myself, not all species have been seen by me. Some illustrations were taken from Hebard (1922a) or Karny (1926a-c) and adapted in size to the original drawings.

1. Anterior tibia with internal (= anterior) tympanum covered by a conchate fold, external (= posterior) tympanum free. *Hemielima*.....2
- Anterior tibia with internal and external tympanum covered by a conchate fold.....3
2. Tegmen long and narrow (in ♂ 6.7×, ♀ 6.2-7.1× longer than wide). Stridulatory file with a strong step-like declination slightly behind middle of length (figs. 14-15). Conchate sclerites of phallus forming a quarter of a circle (fig. 95). Female subgenital plate with apex in middle slightly concave (fig. 118). Eastern Central Thailand ..
.....*E. (H.) procera*
- Tegmen relatively broader (in ♂ 5.7-6.2×, in ♀ 5.8-6.0× longer than wide). Stridulatory file with a weaker step-like declination slightly behind middle of length (figs. 16). Conchate sclerites of phallus forming almost a semicircle (fig. 96). Female subgenital plate with apex in middle subtruncate to slightly convex (fig. 117). Central Thailand*E. (H.) cucullata*
3. Tegmen: radius sector fused with media; media with zigzag course and sending several oblique, subparallel branches to posterior margin of tegmen. Male: tenth abdominal tergite prolonged behind with apex subtruncate. Female: wings shorter than in male but hind wings still slightly surpassing tegmina. Burma, North Thailand, South China*Ectadia fulva*

- Tegmen: radius sector separate; media straight, running about in middle between radius (respectively radius sector) and cubitus; between radius and cubitus with vertical, rather regularly spaced, transverse veinlets. Male: tenth abdominal tergite either not prolonged or if prolonged, apex divided into 2 or 3 lobes. Female: wings of same size as in male.....4
- 4. Anterior femur not compressed, straight (fig. 151). *Orthelimaea*5
- Anterior femur in basal area compressed and phasmid-like curved (figs. 153, 162)6
- 5. Male cerci sickle-shaped, bent in basal third, afterwards flattened (fig. 52). Male subgenital plate split for less than half of its length (fig. 78). Stridulatory file with circa 30 teeth (fig. 2). Female subgenital plate triangular. Ovipositor sabre-shaped, margins with large teeth (fig. 119). Thailand.....*E. (O.) leeuwenii*
- Male cerci gradually curved, slightly widened before apical cone (fig. 51). Male subgenital plate split for more than half of its length (fig. 79). Stridulatory file with circa 70 teeth (fig. 3). Female unknown. Eastern and Central Java.....*E. (O.) minor*
- 6. Phallus with a pair of conchate sclerites (figs. 85-94). Tegmen with radius sector branching about in or behind middle of tegmen (figs. 152-155, 159, 162), rarely (*E. pseudochloris*) before middle (fig. 161). Pronotum often, but not in all species, slightly constricted in circa middle of length.7
- Phallus membranous without sclerites. Tegmen with radius sector branching distinctly before middle of tegmen (figs. 156-158, 160, 164). Pronotum not constricted in middle. *Elimaea*.....37
- 7. Tegmen slightly widening towards apex (width in middle 6 mm, at apex 7 mm). Pronotum with lateral margins of disc angularly rounded. Sumatra (only known from the female type).....*E. (?) marmorata*
- Tegmen narrowing towards apex or of subequal width throughout. Pronotum with lateral margins of disc rounded. *Rhaebelimaea*8
- 8. Tegmen with radius sector branching before middle of tegmen (fig. 161). Male subgenital plate step-like constricted behind base, thereafter narrow, parallel-sided (fig. 73). Stridulatory file with large, spaced teeth throughout (fig. 9). Phallus sclerites as in fig. 93. South Thailand.....*E. (R.) pseudochloris*
- Tegmen with radius sector branching in or behind middle of tegmen (figs. 152-155, 159, 162). Male genitalia of different shape9
- 9. Pronotum and single cells of tegmen densely suffused with black dots, giving the impression of the tegmen being marbled with somewhat irregular, quadrangular, black spots. Male cerci surpassing subgenital plate, round, before apex slightly widened. Male subgenital plate apically prolonged into a long, very narrow projection with bulging lateral margins, split in circa apical quarter with lobes not deviating. Sumatra.....*E. (R.) adspersa*
- Pronotum and tegmen less densely covered with black dots. Male external genitalia of different shape.....10
- 10. ♂♂11
- ♀♀25
- 11. Tenth abdominal tergite largely prolonged behind and apex divided into 2 or 3 lobes.12
- Tenth abdominal tergite not prolonged behind, apex entire (subtruncate, slightly concave or convex).....14
- 12. Tenth abdominal tergite with apical projections long and narrow, forming a three-spined apex. Malaysia, Singapore.....*E. (R.) spinigera*
- Tenth abdominal tergite with apical projections bilobate, rounded.....13
- 13. Subgenital plate split for about apical half into 2 narrow lobes. Borneo, Sumatra? [only known from a male and a female syntype which are possibly not conspecific]*E. (R.) malayica*
- Subgenital plate with apical half entire, only at very apex faintly excised (fig. 74). South Thailand*E. (R.) apicata*
- 14. Subgenital plate bowl-shaped with a conical, narrow, apical part; almost split to base (fig. 71) ..15
- Subgenital plate of different shape, split in apical quarter or at apex only16
- 15. Cerci with black apical cone long and narrow (fig. 29). South Sumatra*E. (R.) willemsei*
- Cerci with black apical cone shorter and stout (fig. 30). Phallus with an unpaired ventral sclerite in addition to the paired conchate sclerites (fig. 90). Stridulatory file sinuate with teeth spaced in circa basal half and dense in circa apical half (fig. 5). Mentawai Islands*E. (R.) sinuata*
- 16. Cerci long, surpassing or embracing subgenital plate (figs. 38-41).....17
- Cerci short, usually shorter than subgenital plate (figs. 31-35)20
- 17. Cerci regularly curved in middle; apical area substraight, apical cone long and narrow; apex acute (fig. 38). Singapore, Riouw, Pulau Ubin.....*E. (R.) signata*
- Cerci re-curved at apex or apical cone short and stout (figs. 39-41)18
- 18. Cerci only in apical area distinctly curved (fig. 41). Subgenital plate with apex of apical lobes transversely truncate (fig. 75). South-East Sumatra.....*E. (R.) hebardii*

- Cerci already curved from middle of length (figs. 39-40). Subgenital plate with apical lobes rounded (figs. 76-77)19
- 19. Subgenital plate split in circa apical third; base broad (fig. 77). Cerci at apex re-curved with margins gradually tapering (fig. 40). Stridulatory file with teeth spaced in basal area (fig. 7). Conchate sclerites of phallus as in figs. 85-86. Mentawai Islands*E. (R.) mentawai*
- Subgenital plate split only at apex; base narrow (fig. 76). Cerci before apex slightly widened and then suddenly constricted to apical cone (fig. 39). Stridulatory file with teeth rather dense from base (fig. 8). Conchate sclerites of phallus as in fig. 94. West Sumatra*E. (R.) maninjauensis*
- 20. Subgenital plate with apical lobes step-like constricted and apex spiniform (fig. 70). North-East Sumatra*E. (R.) roseolata*
- Subgenital plate with apex of different shape...21
- 21. Tegmen with dorsal field considerably widened and on right tegmen with subparallel transverse veins (fig. 17). Stridulatory file very long, teeth gradually changing from spaced teeth at base to dense teeth at apex; at apex with a few spaced teeth (fig. 10). Conchate sclerites of phallus as in fig. 92. Cerci acute-angularly curved with a long, narrow, apical part (fig. 34). West Java (mountainous)*E. (R.) kraussi*
- Tegmen with dorsal field not considerably widened and on right tegmen without subparallel transverse veins. Stridulatory file shorter. Cerci less strongly curved (figs. 31-33, 35)22
- 22. Subgenital plate with apical part narrowly divided; apex of lobes transversely truncate (figs. 66, 68). Java23
- Subgenital plate with apical part broader, roundly excised (figs. 69, 72). Sumatra24
- 23. Cerci with apical cone longer and more slender (fig. 32). Stridulatory file with circa 100 teeth; teeth larger and more spaced (fig. 6). Conchate sclerites of phallus higher (fig. 87). West Java*E. (R.) parumpunctata*
- Cerci with apical cone shorter and stouter (fig. 33). Stridulatory file with circa 80 teeth; teeth in central area more dense (fig. 11). Conchate sclerites of phallus very narrow (fig. 88). East Java*E. (R.) curvicerca*
- 24. Subgenital plate with apical lobes longer and more widely spaced (fig. 69). Cerci more strongly curved (fig. 35). West Sumatra*E. (R.) sumatrana*
- Subgenital plate with apical lobes shorter and closer approached to each other (fig. 72). Cerci less strongly curved (fig. 31). Stridulatory file step-like declined before middle (fig. 12-13). Conchate sclerites of phallus as in fig. 89. North-West Sumatra*E. (R.) modiglianii*
- 25. Subgenital plate with both, long baso-lateral and long apico-lateral projections (figs. 101, 124). Gonangulum of ovipositor with ventro-apical projection pointing apicad (fig. 134). Eastern Central Thailand*E. (R.) pentaspina*
- Subgenital plate with apico-lateral projections only. Gonangulum of ovipositor with ventro-apical projection pointing ventrad (figs. 132-133, 135-136; gonangulum not described for all species!)26
- 26. Subgenital plate constricted before apical lobes which are pointing laterally (figs. 103-104)27
- Subgenital plate not constricted or apical lobes pointing apically (figs. 97-100, 102, 105-108)28
- 27. Subgenital plate at apex more narrowly excised, apical lobes shorter (fig. 104). South-East Sumatra*E. (R.) hebardii*
- Subgenital plate at apex widely excised, apical lobes very long (fig. 103). North-East Sumatra*E. (R.) roseolata*
- 28. Subgenital plate distinctly narrowed towards apex; apex roundly excised between apico-lateral lobes (figs. 105-106, 108)29
- Subgenital plate not narrowed towards apex; if slightly narrowed widely truncate between apico-lateral lobes (figs. 97-100, 102, 107)31
- 29. Subgenital plate with apex rather deeply excised, apical lobes spiniform (fig. 106). Malaysia: Selangor*E. (R.) neglecta*
- Subgenital plate with apex slightly excised (figs. 105, 108)30
- 30. Subgenital plate with apico-lateral lobes acute (fig. 108). Singapore, Riouw, Pulau Ubin*E. (R.) signata*
- Subgenital plate with apico-lateral lobes circa rectangular (fig. 105). West Java (mountainous)*E. (R.) kraussi*
- 31. Subgenital plate with apex almost trilobate, similar to fig. 97, but medial lobe triangular and emarginate. East Java*E. (R.) curvicerca*
- Subgenital plate of different shape; if apex almost trilobate then medial lobe obtuse, not emarginate (fig. 97)32
- 32. Ventral valves of ovipositor at base (between subgenital plate and gonangulum) with a tongue-shaped projection (figs. 121, 136). Subgenital plate as in fig. 97. West Java*E. (R.) parumpunctata*
- Ventral valves of ovipositor at base without tongue-shaped projection (figs. 122-123)33
- 33. Subgenital plate largely widening apicad; apex broad-roundly excised (fig. 107). South Thailand*E. (R.) siamensis*
- Subgenital plate not or only slightly widening apicad; apex more or less truncate between apical lobes or triangularly excised (figs. 98, 102)34

34. Subgenital plate with apico-lateral lobes large (figs. 99-100). Cerci sinuate, apex subacute (figs. 143-144).....35
- Subgenital plate with apico-lateral lobes small (figs. 98, 102). Cerci simply curved, apex obtuse (figs. 140-141).....36
35. Subgenital plate with apico-lateral lobes pointing apico-laterally, apex transversely truncate in between (fig. 99). West Sumatra.....*E. (R.) maninjauensis*
- Subgenital plate with apico-lateral lobes pointing apically; apex triangularly excised in between (fig. 100). Mentawai Islands.....*E. (R.) mentawai*
36. Subgenital plate with apex truncate between apico-lateral lobes but slightly excised in middle (fig. 98). Eastern Central Thailand.....*E. (R.) transversa*
- Subgenital plate with apex convexly truncate between apico-lateral lobes (fig. 102). North-West Sumatra.....*E. (R.) modiglianii*
37. Tegmen long and narrow, its width in middle shorter than length of pronotum (♂) or of about equal length (♀); tegmen parallel-sided or in some males slightly narrowed in middle and widening towards apex (about 1 mm). Pronotum with lateral lobes distinctly longer than high. *Elimaea poaeifolia*-group.....38
- Tegmen not so narrow; its width in middle distinctly longer than length of pronotum; costal area usually widened in about basal half (figs. 158, 160, 164). Pronotum with lateral lobes only little longer than high. *Elimaea* s. str.44
38. ♂♂39
- ♀♀41
39. Cerci distinctly shorter than subgenital plate. Subgenital plate suddenly narrowed behind basal area. West Sumatra.....*E. (E.) jacobsonii*
- Cerci of subequal length with subgenital plate. Subgenital plate more gradually narrowed.....40
40. Java.....*E. (E.) poaeifolia*
- Borneo; also in Malaysia?*E. (E.) rosea*
41. Subgenital plate with lateral margins converging in circa apical half; apex roundly excised and with apico-lateral angles acute. Java.....*E. (E.) poaeifolia*
- Subgenital plate with apex not roundly excised.....42
42. Fastigium verticis not furrowed. Subgenital plate short, apex obtuse, at each side provided with a narrow, acute lobe. Borneo; also in Malaysia?*E. (E.) rosea*
- Fastigium verticis furrowed. Subgenital plate without a narrow acute lobe at each side. Thailand.....43
43. Subgenital plate with apex transversely truncate and slightly excised in middle; at each apico-lateral angle with 2 short obtuse lobes (fig. 115). Gonangulum of ovipositor longer, pointing more or less apicad (fig. 138). Northern Thailand.....*E. (E.)* sp. 1
- Subgenital plate with apex obtuse-triangular with somewhat irregular margin, at each side with a short conical projection (fig. 114). Gonangulum of ovipositor shorter, pointing more or less ventrad (fig. 137). Western Thailand.....*E. (E.)* sp. 2
44. Male: Subgenital plate split in circa apical half or more (figs. 55-56). Cerci rather strongly bulging before apex (figs. 49-50). Stridulatory file with circa 28-29 rather large and spaced teeth (figs. 27-28). Female: Cerci with apex rather broad, obtuse (fig. 145). Eastern Central Thailand, Hawaii Islands.....*E. (E.) nautica*
- Male: Subgenital plate split in less than apical half, usually split in apical third only (figs. 59-65); if split for almost apical half (figs. 57-58) then stridulatory file with 34-42 teeth (figs. 24-25). Cerci only slightly widened before apex (figs. 42-48). Female: Cerci with apex narrow, subacute (figs. 146-150).....45
45. Male: Stridulatory file with less than 20 large and widely spaced teeth in basal and central area and a variable number of minute teeth in apical area (figs. 18-23). Female: Gonangulum of ovipositor with a large ventro-apical appendage (figs. 127-128). Apex of subgenital plate only faintly excised or apical lobes approached to each other (figs. 111-113).....46
- Male: Stridulatory file with more numerous and less widely spaced teeth which are gradually decreasing in size from central area to apex (figs. 24-26). Female: Gonangulum of ovipositor with a small ventro-apical appendage (figs. 129-130). Apex of subgenital plate with two widely spaced, obtuse, apical lobes (fig. 110). [Female of *E. punctifera* unknown].....47
46. Male: Stridulatory file with circa 32-35 (14-16 large) teeth. Female: Apex of subgenital plate only faintly excised in middle (fig. 111). Cerci less strongly curved (fig. 148). Central Thailand to Java.....*E. (E.) chloris*
- Male: Stridulatory file with circa 9-17 (6-9 large) teeth. Female: Apex of subgenital plate terminating into 2 subacute to subobtuse lobes which are only narrowly separated from each other (figs. 112-113). Cerci more strongly curved (fig. 146). Hongkong to North East India.....*E. (E.) subcarinata*
47. Male: Stridulatory file with circa 53 teeth (fig. 26). Cerci with apical cone long and robust (fig. 44). Subgenital plate split in circa apical quarter to apical third (figs. 61-62). Female unknown. Bangladesh.*E. (E.) punctifera*
- Male: Stridulatory file with circa 34-42 teeth (figs. 24-25). Cerci with apical cone short and

slender (fig. 48). Subgenital plate split for somewhat less than apical half (figs. 57-58). Female: Apex of subgenital plate with 2 short obtuse lobes and broadly truncate in between (fig. 110). Thailand.....*E. (E.) thaii*

ELIMAEINI YAKOBSON, 1905: 324, 373

Elimaeini Yakobson, 1905: 324, 373; Bei-Bienko 1954: 115. Elimaeae Brunner, 1878: 90.

Diagnosis. – Antennae elastic (less so in *Ectadia*). Fastigium verticis forming a right angle with fastigium frontis. Pronotum with a distinct humeral sinus. Anterior coxa without spine but in some species with a minute spinule. Anterior femur on ventral side furrowed and provided with small spines. Anterior tibia dorsally furrowed and provided with (small) dorso-apical spurs. Tibial tympana covered by a conchate fold with wide anterior slit on both sides or on internal (= anterior) side only. Tegmina fully developed, hind wings surpassing tegmina in both sexes. Male subgenital plate without styli. Ovipositor usually falcate, rarely sabre-shaped, little longer than pronotum.

Ectadia Brunner, 1878

Ectadia Brunner, 1878: 103. Type species: *Ectadia pilosa* Brunner, 1878; by monotypy.

Diagnosis. – Elimaeini with modified tegminal venation and sexual wing dimorphism. Radius sector fused with media; media with a zigzag course and sending several oblique, subparallel branches to posterior margin of tegmen. Tegmen of male with dorsal area widened. In the female, both pairs of wings slightly shortened but hind wings surpassing tegmina. Tibial tympana conchate on both sides.

Distribution. – The genus is known from Kashmir and from the mountainous region of eastern Burma, northern Thailand and Yunnan (map 1).

Ectadia fulva Brunner

Ectadia fulva Brunner, 1893: 167. Holotype, ♂, Burma, Carin Cheba, MCSN [not seen]. – Bei-Bienko 1962: 122. *Ectadia abbreviata* Brunner, 1893: 167, fig. 58. Holotype, ♀, Burma, Carin Ghecu, MCSN [not seen].

Material examined. – Thailand: 1 ♂, Chiang Mai prov., Doi Suthep-Pui, 1100-1200m, 22.x.1990; 1 ♂, 1 ♀, same data but 13.iv.1995; 23 ♂, 21 ♀, same data but ex ovo; 1 ♂, 1 ♀, Mae Hong Son prov., mountains between Samoeng - Pa Pae, 30.iv.1988; 1 ♀, Nan prov., Doi Phukha, 1500m, 5.x.1991, all ci.

Remarks. – The species is sufficiently described and figured in Brunner (1893). The female of this species was described under the name *Ectadia abbreviata* Brun-

ner, 1893 as already recognised by Bei-Bienko (1962).

The tegminal venation, especially the irregular course of the media and the network of strong transverse veinlets resembles the situation in *Mirollia* Stål, 1873 but in a less extreme form. The rather stout and breakable antennae and the sexual wing dimorphism resemble the condition in the Acrometopini. However in contrast to the latter, the antennae are somewhat more flexible and in the female, the hind wings still surpass the tegmina although both pairs of wings are slightly shortened. The male cerci are curved and strongly compressed except for a short conical part at base. They are similar to that of *O. leeuwenii*. *E. fulva* shows a green brown colour dimorphism.

Development. – Oviposition was in parenchyma of leaves of wheat, between the layers of absorbent paper and in polystyrene. The eggs are of typical Phaneropterinae shape, compressed kidney-shaped. Egg development required 37-94 (mean 52) days at 20-23°C. There were 6 larval instars. The first larval instar is pale reddish brown with 3 longitudinal white stripes (fig. 168). Legs and antennae are almost colourless. Body and legs are dotted with black. Larval development (from hatching to adult) required 52-68 days at 20-23°C. In captivity, larvae and adults readily fed the following European plants: leaves of *Triticum* and *Rumex* as well as flowers of *Rumex*, *Achillea*, *Chrysanthemum*, and *Bellis*, and less readily leaves of *Rubus* and *Taraxacum*.

Stridulation (fig. 169). – The song of one male from Doi Suthep (Chiang Mai province, Thailand) was recorded at 20.5°C. Stridulation consists of a sequence of about six echemes, the first echeme slightly quieter than the following. Each echeme consists in the first half of crescendoing pulses which are separated by rather large pauses from each other. The second half of an echeme is quieter, the repetition of the decrescendoing pulses becomes increasingly faster, such that in the last quarter of an echeme single pulses can not be recognised, even with a high time resolution. At the end of an echeme the song intensity becomes loud again. The echemes lasted between 1640 and 1890 ms, the echeme interval varied between 4900 and 6050 ms. The main frequency of the song was about 6-14 kHz. The sound of an echeme can be circumscribed as "rrrrr ziiip", with the second part of the sound quieter than the first. Stridulation of *Ectadia fulva* with an extreme acceleration of the stridulatory elements (syllables or pulses) within one echeme is rather curious.

Elimaea Stål

Elimaea Stål, 1874: 27. Type species: *Phaneroptera subcarinata* Stål, 1861; by monotypy.

Diagnosis. – Elimaeini with posterior margin of tegmen straight; radius, radius sector, media and cu-

bitus running parallel and almost equally spaced from each other; transverse veinlets dense, standing parallel and almost vertical on principle veins (figs. 151-164).

Elimaea (Orthelimaea) Karny

Orthelimaea Karny, 1926a: 23. Type species: *Elimaea (Orthelimaea) leeuwenii* Karny, 1926a; by original designation.

Diagnosis. – Elimaeini with straight anterior femora. Tibial tympana covered by a conchate fold on both sides. Greatest width of tegmen wider than length of pronotum; radius sector branching about in middle of tegmen. Male cerci either compressed or subcylindrical with an apical conus. Phallus membranous, but dorsal lobes in some species provided with a longitudinal rim covered with spinules. Ovipositor short sabre-shaped with basal area substraight and apical area with stout teeth or falcate with margins in apical area finely serrulate; gonangulum with ventral margin projecting, but sometimes not very distinct.

Remarks. – *Orthelimaea* is heterogeneous with regard to the male cerci, the phallus and the female ovipositor. It is thus possible that this subgenus is a heterogeneous assemblage of species and must be further subdivided. However, as most species referred to *Orthelimaea* are known from the Indian subcontinent, we have to wait until those species are carefully revised.

Distribution. – The subgenus has its greatest species diversity on the Indian subcontinent but spreads into Central China and Thailand; a single species is known from each, Java and Sulawesi (map 1).

Elimaea (Orthelimaea) leeuwenii Karny
(figs. 2, 52, 78, 116, 119, map 3)

Elimaea (Orthelimaea) leeuwenii Karny, 1926a: 24, fig. 90. Syntypes, 2♂, Thailand, Bangkok, 5.xi.1920. Docters van Leeuwen: 1♂ (without type label) in MZB [examined], 1♂ (labelled holotype) in RMNH. – Ingrisch 1990a: 91, figs. 1-2.

Material examined. – Thailand: 2♀, Chiang Mai prov., Phrao district, Phrao - Ban Pradu, 26.-29.ix.1985; 1♀, Chiang Mai prov., 8.x.1991; 1♀, Nakhon Ratchasima prov., Pak Chong, 16.x.1990; 3♂, Kanchanaburi prov., Thong Pha Phum, 15.vi.1986; 1♀, Kanchanaburi prov., Erawan falls, 17.-19.vi.1986; 2♂, 2♀, do. 2.vi.1988; 2♀, Prachuap Khiri Khan prov., Hua Hin, 26.vii.1992, all cr.

Remarks. – The male of this species is already sufficiently described in Karny (1926a), the female in Ingrisch (1990a). The diagnostic characters are outlined in the key. The stridulatory file bears circa 31 teeth which are gradually decreasing in size towards apex but remain rather large throughout.

The species is widespread in Central and Northern Thailand and was so far collected from the Chiang

Mai province in the north to the Prachuap Khiri Khan province in the south (map 3).

Development. – In contrast to all other *Elimaea* species, *E. leeuwenii* has a sabre-shaped instead of a sickle-shaped ovipositor. Oviposition of one female in laboratory was in the soil; but the eggs were obviously not fertilised as no hatching occurred.

Elimaea (Orthelimaea) minor (Brunner) comb. n.
(figs. 3, 51, 79, 151)

Elimaea minor Brunner, 1891: 48. Syntypes [not seen], 3 males: 2♂, Indonesia, Java, Tengger mountains, H. Fruhstorfer (18.190; NHMW); 1♂, Java, Dr. Dohrn (18.435; NHMW).

Elimaea (Rhaebelima) minor Karny 1926a: 20.

Material examined. – Indonesia: 1♂, East Java, Tretes, Gunung Arjuna, 1300m, mixed forest, 26.iii.1995; 1♂, Central Java, Gunung Lawu, Tawangmangu - Sarangan, 1400m, mountain forest, 29.iii.1993, both cr.

Description. – Small species with parallel-sided tegmen (fig. 151).

Male: Stridulatory file with circa 70 teeth which are gradually decreasing in size towards apex (fig. 3). Cerci regularly curved, slightly constricted in middle and widened again before apex, apical cone subacute (fig. 51). Subgenital plate slightly constricted behind basal area, split into 2 lobes for more than apical half (fig. 79); internal surface of resulting lobes densely covered with minute spinules.

Female unknown.

Coloration: Green; posterior margin of pronotum and dorsal field of tegmen (including stridulatory area) brown. Tegmen with brown dots in cells between media and cubitus and a row of single larger dots between radius (respectively radius sector) and media. Variation: In the male from Gunung Lawu which was collected as a freshly moulted specimen, the dark pattern is largely absent.

Measurements of male (length in mm): Body 17; pronotum 3.5; tegmen 21.0-23.0; tegmen width 4.0-4.5; anterior femur 5.7-6.0; mesofemur 7.5-8.0; postfemur 17.0-18.0.

Remarks. – In the original description (Brunner 1891) and later in Karny (1926a) it is said that this species has the anterior femora curved in a phasmid-like fashion. Accordingly, the species was combined with *Rhaebelima* by Karny (1926a). This information is based on an error. In the specimens at hand as well as in the original type series (3♂ syntypes, "coll." and "det. Brunner v. Wattenwyl" without type labels in NHMW, information by Dr. A. Kaltenbach 19.xii.1996), the anterior tibiae are straight, without the phasmid-like modification. The species must thus be grouped with *Orthelimaea*.

Elimaea (Hemielimaea) Brunner stat. n.

Hemielimaea Brunner, 1878: 103. Type species: *Hemielimaea chinensis* Brunner, 1878; by monotypy.

Diagnosis. – Elimaeini with straight anterior femora. Tibial tympana covered by a conchate fold on internal, open on external side. Greatest width of tegmen wider than length of pronotum; radius sector branching about in middle of tegmen. Phallus with a pair of conchate sclerites. Ovipositor falcate; gonangulum with ventral margin projecting; dorsal margin of ventral valves laterally projecting at base and curved around projection of gonangulum.

Distribution. – The area of this subgenus stretches from Eastern and Central China to Central Thailand (map 1). There are probably more, superficially similar, *Hemielimaea* species in Thailand than the following two. But the few additional specimens in DAB (3 ♂, 3 ♀) and CI (1 ♀) do not allow to be certain about the individual variation. The stridulatory songs of individuals from different localities should also be studied to determine whether small morphological differences are due to individual variation or are species specific.

Elimaea (Hemielimaea) procera (Ingrisch) comb. n. (figs. 14-15, 53, 81, 95, 118, map 3)

Hemielimaea procera Ingrisch, 1990a: 94, figs. 7, 14-16. Holotype ♂: Thailand, Chanthaburi prov., Khao Soi Dao, 31.v.1986, SMF [examined].

Material examined. – Thailand: 3 ♀, Chanthaburi prov., Khao Soi Dao, 12.vi.1988, CI.

Description. – Fastigium verticis narrow, dorsal margin sinuate, furrowed; step-like declined to fastigium frontis. Pronotum with disc nearly flat, lateral margins rounded; transverse sulcus broad V- or short Y-shaped; paranota about as high as long; ventral and posterior margins rounded together; humeral sinus distinct. Tegmen sub-parallel-sided, in male about 6.7 times, in female 6.2-7.1 times longer than wide; radius sector branching in about middle. Anterior femur with spines on both ventral margins. Meso- and postfemur with spines on ventro-external margin only. Knee lobes of all femora bispinose. Anterior tibia with external and internal, dorsal and ventral apical spurs.

Male: Stridulatory file with a distinct step slightly behind middle of length, with circa 100 teeth (figs. 14-15). Tenth abdominal tergite with apex subtruncate. Epiproct small, triangular. Cerci long, rather regularly curved, hardly widened before apex, apical cone subacute (fig. 53). Subgenital plate regularly curved from base to apex, constricted before middle, split in circa apical third, internal margins of resulting lobes densely covered with spinules (fig. 81). Phallus with a pair of conchate sclerites with serrulate margin as in fig. 95.

Female: Tenth abdominal tergite narrow but entire.

Epiproct tongue-shaped. Cerci slightly curved, slightly widening behind base, widest in circa middle, apex subacute. Subgenital plate semicircular in general outline, apex subtruncate in middle; lateral areas faintly grooved and with fine transverse furrows; central area faintly and broadly furrowed (fig. 118); at each side of subgenital plate intersegmental membrane with an awl-shaped appendage. Ovipositor falcate, stout; dorsal margin serrate in circa apical half, ventral margin in apical area; gonangulum slightly projecting ventrad, projection sticking in a curved fold of the dorsal margin of the ventral ovipositor valves; dorsal margin of the ventral ovipositor valves widened at base and acute-angularly excised at end of widening.

Coloration: Green. Antenna black with spaced light rings, but scapus and pedicellus with anterior surface light, posterior (= dorsal) surface dark. Vertex with a pair of longitudinal black bands. Pronotum with complete or incomplete black lateral bands (distinct at anterior and posterior margins, often dissolved into dots or absent in middle). Tegmen with dorsal area black with light veinlets, otherwise green with dark dots in the cells between radius and cubitus and between subcosta and anterior margin.

Measurements (length in mm): Body ♂ 21, ♀ 23-26; pronotum ♂ 4.5, ♀ 4.5-4.9; tegmen ♂ 37.0, ♀ 39.0-40.5; tegmen width ♂ 5.5, ♀ 5.5-6.0; anterior femur ♂ 7.5, ♀ 8.5-9.0; mesofemur ♂, ♀ 11.5-13.0; postfemur ♂ 26.0, ♀ 27.0-29.5; ovipositor 8.5-9.0.

Elimaea (Hemielimaea) cucullata (Ingrisch) comb. n. (figs. 16, 54, 80, 96, 117, map 3)

Hemielimaea cucullata Ingrisch, 1990a: 96, figs. 8, 17-22. Holotype ♀: Thailand, Kanchanaburi prov., Erawan falls, 17.-19.vi.1986, SMF [examined].

Material examined. – Thailand: 2 ♂, 1 ♀, Kanchanaburi prov., Erawan falls, 1.vi.1988; 1 ♂, do. 9.iv.1994 ex larva.

Description. – Fastigium verticis narrow, deeply furrowed and dorsal margin sinuate; step-like declined to fastigium frontis. Pronotum with disc nearly flat and lateral angles broadly rounded; anterior margin concave, posterior margin convex; transverse sulcus Y-shaped; paranota in male circa 1.1x longer than high, in female as high as long, ventral and posterior margins rounded together; humeral sinus distinct. Tegmen in male 5.7-6.2 times, in female 5.8-6.0 times longer than wide, anterior margin slightly convex and tegmen thus gradually narrowing towards apex; radius sector branching about in middle of tegmen. Anterior femur with spines on both ventral margins. Meso- and postfemur with spines on ventro-external margin only. Knee lobes of all femora bispinose. Anterior tibia with external and internal, dorsal and ventral apical spurs.

Male: Stridulatory file with a rather weak step in circa middle of length, with about 90 - 109 teeth (fig. 16). Tenth abdominal tergite with a Y-shaped sulcus; apical margin slightly sinuate. Epiproct long-triangular with apex broadly rounded. Cerci curved, slightly widening behind base, widest in basal half, apex with a strong, acute cone (fig. 54). Subgenital plate with lateral margins sloping and approaching each other in circa basal half, narrow and with subparallel lateral margins in apical half; split in circa apical third, apical lobes setose and on internal side of apical lobes with strong spinules (fig. 80). Phallus with a pair of conchate sclerites with serrate apical margin (fig. 96).

Female: Epiproct triangular, apex rounded. Cerci slightly curved, widest in circa middle, apex obtuse. Subgenital plate short-rectangular, apex rounded (fig. 117); at each side of subgenital plate intersegmental membrane with an awl-shaped appendage. Ovipositor falcate, stout; dorsal margin serrate in circa apical half, ventral margin in apical area; gonangulum slightly projecting ventrad, projection sticking in a curved fold of the dorsal margin of the ventral ovipositor valves; dorsal margin of the ventral ovipositor valves widened at base and acute-angularly excised at end of widening.

Coloration: Green. Antenna black with spaced light rings, but scapus and pedicellus with anterior surface light, posterior (= dorsal) surface dark. Vertex with a pair of longitudinal black bands. Pronotum with incomplete black lateral bands (distinct at anterior and posterior margins, dissolved into dots or absent in middle). Tegmen with dorsal area black with light veinlets, otherwise green with indistinct dark dots in the cells between radius and media and eventually between media and cubitus.

Measurements (length in mm): Body ♂ 20-22, ♀ 20-23; pronotum ♂ 4.2-4.5, ♀ 4.0-4.5; tegmen ♂ 31.5-34.5, ♀ 36.0-38.0; tegmen width ♂ 5.5, ♀ 6.0-6.5; anterior femur ♂ 7.0-8.0, ♀ 7.5; mesofemur ♂ 10.5-11.5, ♀ 11.0; postfemur ♂ 22.0-24.5, ♀ 25.0; ovipositor 8.0-8.5.

Stridulation (fig. 170). – The song of one male from Erawan waterfall (Kanchanaburi province, Thailand) was recorded at 21.5°C. Stridulation consists of an echeme with crescendoing syllables and, separated by a short pause from the syllables, a loud final zip-sound. The resulting sound can be circumscribed as “trrrrrr zip”, with the zip-sound louder than the first part of the echeme. The echemes were often grouped in loose sequences with 2-5 echemes which were repeated with an interval of 8-17 s. Between those sequences the male was quiet for several minutes.

The echemes lasted 1281-1443 ms. There were 16-17 syllables per echeme. The syllables were repeated with an interval of 55-84 ms, while the final zip-sound followed 330-340 ms after the beginning of the preceding syllable. Syllable duration varied between

21-73 ms. The main frequency of the song was about 13-24 kHz, that of the final zip-sound 9-24 kHz.

Stridulation of *Hemielimaea cucullata* resembles the songs of the Mediterranean *Acrometopa* species (compare Heller 1988). This might be a hint for a relationship between the Elimaeini and the Acrometopini as proposed by Brunner (1878), if the more complex male stridulation of *Hemielimaea* compared with *Elimaea* is the more primitive one. It is however also possible that the similar time pattern in both genera (*Hemielimaea* and *Acrometopa*) resulted from convergent evolution.

Elimaea (Rhaebelimaea) Karny

Rhaebelimaea Karny, 1926a: 26. Type species: *Phaneroptera parumpunctata* Serville, 1839; here designated.

Diagnosis. – Elimaeini with anterior femora curved as in phasmids. Tibial tympana covered by a conchate fold on both sides. Greatest width of tegmen wider than length of pronotum; radius sector usually branching about in middle of tegmen, rarely distinctly before middle. Phallus with a pair of conchate sclerites. Ovipositor falcate, dorsal margin in apical half, ventral margin only at apex finely serrulate; gonangulum with ventro-apical angle projecting.

Remarks. – Several cases of misidentification of species are summarised in Karny (1926a).

Distribution. – The species of this subgenus live in a rather restricted area from Sumatra in the west to the Philippines in the east and from Java in the south to central Thailand in the north (map 2). A few species from South India and Sri Lanka might also belong here, but without re-examining the specimens, it is not possible to be certain about their subgeneric status. *Rhaebelimaea* species usually live in forests and have very restricted ranges, many of them have so far been recorded from a single locality.

Elimaea (Rhaebelimaea) parumpunctata (Serville) (figs. 6, 32, 68, 87, 97, 121, 136, 152, 167)

Phaneroptera parumpunctata Serville, 1839: 418. Holotype, ♀, Indonesia, Java, MNHN? [not seen].

Elimaea (Rhaebelimaea) parumpunctata Karny 1926a: 34, fig. 95.

Material examined. – Indonesia: 1 ♀, West Java, Gunung Salak, above Ciapus, Sukamandri, 850-950m, *mountain forest*, 27.ii.1995; 4 ♂, same data but ex ovo; 1 ♀, West Java, Cibodas, Botanical Gardens, 1400m, 24.iii.1993 ex larva; 1 ♀, same data but 1.iv.1995, all ci.

Description. – Male: Stridulatory file with circa 104 teeth which are gradually decreasing in size towards apex (fig. 6). Cerci shorter than subgenital plate, strongly curved, widened before apex, apical cone slender, subacute (fig. 32). Subgenital plate strongly narrowing

from base to circa middle of length, apical area narrow; apex split into 2 slightly diverging lobes with obliquely truncate apex (fig. 68). Phallus with a pair of semi-ovoid, conchate sclerites (fig. 87).

Female: Subgenital plate transverse, subdivided in middle, apex with slightly diverging cones at lateral angles, sinuate in between (fig. 97). Ventral ovipositor valves with a tongue-shaped appendage at base between gonangulum and subgenital plate (figs. 121, 136); gonangulum with a weak, broadly rounded ventral projection (fig. 136).

Coloration: Green. Pronotum with incomplete black lateral bands and with black dots. Tegmen in male with dorsal field black with orange veinlets, in female green with black dots; aggregations of black dots in cells between media and cubitus and rows of single larger dots between radius (respectively radius sector) and media. Variation: In the female the dark pattern is hardly expressed; instead, in the live specimen, pronotum with white lateral bands and tegmen with white posterior margin (fig. 152).

Measurements (length in mm): Body ♂ 21-22, ♀ 20-21; pronotum ♂ 3.8-4.2, ♀ 3.5-3.8; tegmen ♂ 31.0-32.0, ♀ 31.0-33.0; tegmen width ♂ 5.0, ♀ 5.0-5.5; anterior femur ♂ 7.0, ♀ 7.5-8.0; mesofemur ♂ 9.5-10.0, ♀ 9.0-10.0; postfemur ♂ 20.5-22.0, ♀ 21.0-22.0.

Development. – Oviposition was in parenchyma of leaves. The eggs are compressed kidney-shaped. Egg development required 41-43 days at 25-28°C. There were 6 larval instars. The first instar larvae is green with 3 longitudinal rows of white dots and the abdominal apex white (fig. 167). The legs are olivaceous to yellowish brown and densely covered with black dots. The antennae are blackish brown with white annulation. Larval development (from hatching to adult) required about 63-75 days (temperature not controlled, but always above 20°C). In captivity, the species fed on a variety of plants including *Mentha*, *Rumex*, wheat, seedlings of sunflower, as well as on dry rolled oats.

Stridulation (fig. 171). – Stridulation of two males bred from the egg from Gunung Salak (West Java, Indonesia) was recorded at 24.5° and 27°C. Two different songs were produced by the same male, a short song consisting of a single syllable and a long song consisting of a sequence of 4-8 syllables. The time pattern of the syllables was the same in both song types.

The syllables lasted 29-73 ms in the long songs at 27°C and 54-61 ms in the short songs at 24.5°C. The long songs lasted 1210-2500 ms, depending on the number of syllables, with a syllable repetition rate of 282-312 ms. The mean frequency of both song types was 12-24 kHz. The sound of a syllable can be circumscribed as "zip", the long songs are a repetition of this sound.

Elimaea (Rhaebelimaesa) curvicerata Brunner stat. rev. (figs. 11, 33, 66, 88, 155)

Elimaea curvicerata Brunner, 1891: 50. Syntypes, ♂, ♀, Java orientalis, NHMW [not seen].

Elimaea (Rhaebelimaesa) parumpunctata partim Karny 1926a: 34.

Material examined. – Indonesia: 1♂, East Java, Tretes, Gunung Arjuna, 1000m, mixed forest, 26.iii.1995, ci.

Description. – Male: Stridulatory file with circa 79 teeth, gradually decreasing in size towards apex (fig. 11). Cerci strongly and angularly curved, distinctly constricted and then widening again before apex, apical cone long, apex subacute (fig. 33). Subgenital plate narrowing from base to circa middle of length, apical area narrow, apex split into 2 lobes with bulging internal margin, apex of lobes obliquely truncate (fig. 66). Phallus with a pair of very slender, conchate sclerites (fig. 88).

Female: According to the description in Brunner (1891), the subgenital plate is similar to that of *R. parumpunctata*, but the medial lobe emarginate in middle.

Coloration (male): Green. Pronotum with black lateral bands which are obsolete in metazona and with black dots. Tegmen with dorsal field black with orange veinlets, stridulatory vein green; aggregations of black dots in cells between media and cubitus and rows of single larger dots between radius (respectively radius sector) and media. Mesofemur with a ventral black spot at base and a row of black dots on external surface. In the live specimen, central part of vertex, disc of pronotum and anterior part of stridulatory area of tegmen before stridulatory vein white.

Measurements of male (length in mm): Body 19; pronotum 3.8; tegmen 29.0; tegmen width 6.0; anterior femur 6.0; mesofemur 9.0; postfemur 20.0.

Remarks. – The species was previously regarded to be a synonym of *E. parumpunctata* (Serville, 1839) (Karny 1926a). It shows however distinct differences in the stridulatory file as well as in external and internal male genitalia. It is regarded here as a distinct species. The differences between both taxa are outlined in the key.

Elimaea (Rhaebelimaesa) kraussi Karny (figs. 10, 17, 34, 67, 92, 105)

Elimaea (Rhaebelimaesa) kraussi Karny, 1926a: 31, fig. 92. Syntypes, 4♂, 1♀, West Java, Cibodas, 1400m, xi./xii.1921, H.H. Karny, 3♂ in MZB [examined], 1♂, 1♀ in RMNH.

Material examined. – Indonesia: 2♂, West Java, Gunung Pangrango, Botanical Garden to Cibeureum waterfall, 1400-1700m, primary mountain forest, 25.iii.1993, ci.

Description. – Male: Stridulatory file with circa

102 teeth which are distinctly spaced in circa basal half (circa 35 teeth), very narrow and dense in apical half; at apex there are a few small and widely spaced teeth (fig. 10). The dorsal field of the right tegmen (covered by the left tegmen when at rest) carries a series of rather regularly spaced transverse veinlets which are raised and forming transverse ridges (fig. 17). Cerci short, substraight at base and then curved in a more than 90°-angle before the very long and slender apical cone (fig. 34). Subgenital plate with apical area narrow, apex shortly divided into 2 lobes with faintly bulging internal margins, apex of lobes obliquely truncate (fig. 67). Phallus with a pair of circa semi-ovoid conchate sclerites (fig. 92).

Remarks. – The species was already extensively described by Karny (1926a). Some additional notes on stridulatory file and male genitalia are added.

Elimaea (Rhaebelimaesa) mentawei sp. n.
(figs. 7, 40, 77, 84-86, 100, 123, 135, 144, 159)

Holotype ♂: Indonesia, Mentawai exp., H.H. Karny, R.M. 17.x.1924, MZB. – Paratypes: Indonesia, Mentawai exp., H.H. Karny, all MZB: 1♂, no. 95, Siberut, 23.ix.1924; 1♀, no. 112, Siberut, 25.ix.1924; 1♂, no. 163, Sipora, 9.x.1924; 2♂, no. 170, Sipora, 10.x.1924; 1♀, no. 173, Sipora, 11.x.1924; 2♀, no. 174, Sipora, 12.x.1924; 1♀, no. 183, Sipora, 15.x.1924; 1♂, no. 187, 17.x.1924; 2♀, no. 188, 17.x.1924; 1♀, no. 227, Sipora, 31.x.1924; 2♂, R.M. 17.x.1924; 1♂, 1♀, R.M. 18.x.1924; 1♂, R.M. 21.x.1924; 1♀ (allotype), R.M. 22.x.1924; 1♂, Mentawai, Sipora, Sereina, v.-vi.1894, Modigliani, MCSN; 3♂, 1♀, Mentawai, Si Oban, iv.-viii.1894, Modigliani, MCSN.

Description. – Fastigium verticis with dorsal surface roundly declined; dorsal surface shallowly furrowed. Pronotum with disc slightly rounded to nearly flat, but in posterior area slightly concave, lateral margins rounded into paranota; anterior margin concave in middle, posterior margin rounded; transverse sulcus circa triangular, in or slightly behind middle of pronotum length; paranota about as long as high or faintly longer, anterior angle angularly rounded, posterior angle broadly rounded, humeral sinus weak but distinct. Tegmen surpassing hind knees; with subparallel transverse veinlets in circa basal half of tegmen; radius sector branching somewhat before or behind middle of tegmen or even distinctly behind, this character somewhat variable even on left and right tegmen of the same specimen. Anterior femur with dorsal margins angular. Anterior femur with spines on ventro-internal margin or on both ventral margins (varying between individuals), mesofemur with spines on ventro-external margin, postfemur without spines or with a few spines on ventro-external margin. Knee lobes of all

femora bispinose or individual lobes unispinose.

Male: Stridulatory file with circa 82 teeth which are distinctly spaced in basal half, dense but regularly spaced in apical half (fig. 7). Tenth abdominal tergite with apical margin subtruncate. Epiproct long tongue-shaped, slightly curved from base to apex, shallowly depressed in basal area (fig. 84a). Cerci long, curved ventrad near base and mediad near apex, at the turning point between ventral and medial curvature cercus slightly narrowed; apex forming a curved, tri-edged cone (fig. 40). Subgenital plate elongate, basal area with sloping lateral margins, central area prolonged behind and narrow, apex split to a variable degree with apices of lobes obtuse (fig. 77). Phallus with a pair of mussel-shaped, large, hyaline sclerites, with concave internal and convex external surface; external surface in basal area covered by membrane; dorso-apical margin finely serrulate (figs. 85-86).

Female: Tenth abdominal tergite with apical margin subsinuate. Epiproct long, triangular with apex rounded; dorsal surface slightly curved from base to apex. Cerci curved, widest near middle of length; apex pointed (fig. 144). Subgenital plate transverse, divided in midline but both halves connected by strong membrane, apico-lateral angles acute-angularly projecting behind (fig. 100). Gonangulum of ovipositor with a short, obtuse, ventral projection that inserts into a fold of the ventral ovipositor valves (fig. 123, 135).

Coloration: Green when alive. Pronotum: disc margined with dark brown lateral bands and dark spots on both sides of the bands (more distinct in ♂ than in ♀). Tegmen: area behind media with dark cells and pale veinlets; area between radius and media usually with one or behind branching of radius sector with 2 rows of dark spots; towards apex with or without small dark dots; dorsal field brown in male only.

Measurements (length in mm): Body ♂ 18-23, ♀ 17-23; pronotum ♂ 4.0-5.0, ♀ 4.5-4.7; tegmen ♂ 35.0-40.0, ♀ 37.0-41.0; tegmen width ♂ 6.0, ♀ 6.0-6.5; postfemur ♂ 24.0-29.0, ♀ 27.0-29.0; ovipositor 8.0-8.5.

Etymology. – The name of the new species is chosen from the type locality, the Mentawai Islands west of Sumatra.

Elimaea (Rhaebelimaesa) maninjauensis sp. n.
(figs. 8, 39, 76, 94, 99, 122, 143, 153)

Holotype ♂: Indonesia, West Sumatra, Maninjau, 500-700m, 16.iii.1995 ex larva, S. Ingrisch, MZB. – Allotype: 1♀, Indonesia, West Sumatra, Maninjau, 14.iii.1993, ci.

Description. – Fastigium verticis narrow, sulcate, apex obtuse and step-like declined to fastigium frontis. Pronotum with disc nearly flat, especially in pos-

terior area, lateral angles rounded, apical area shouldered; anterior margin faintly concave in middle, posterior margin rounded; transverse sulcus Y-shaped; paranota almost as high as long; ventral margin rounded, humeral sinus present. Tegmen surpassing hind knees; anterior margin convex, posterior margin substraight; radius sector branching slightly before or in middle of tegmen. Anterior femur with dorsal margins angular. Anterior femur with spines on ventro-internal margin, mesofemur with spines on ventro-external margin, postfemur without spines or with one spine on ventro-external margin. Knee lobes of anterior femur bispinose on external, unispinose on internal side, of mesofemur unispinose on external, bispinose on internal side, of postfemur bispinose on both sides. Anterior tibia with dorsal and ventral, external and internal, apical spurs.

Male: Stridulatory file curved behind base, otherwise substraight with about 126 teeth which become regularly narrower from base to apex (fig. 8). Tenth abdominal tergite distorted in specimen at hand. Epiproct long tongue-shaped, apex rounded, with a broad medial furrow in basal area. Cerci strongly curved near base, afterwards moderately curved; apex terminating into a stout, triangular, acute tooth (fig. 39). Subgenital plate narrow even at base, basal area with sloping lateral margins, central area prolonged behind into a long, narrow, medial process with subparallel margins behind middle and with a weak and broad medial furrow, apex shortly divided into two obtuse lobes (fig. 76). Phallus with a pair of mussel-shaped, large, hyaline sclerites, with serrulate margin (fig. 94).

Female: Tenth abdominal tergite with apical margin subtruncate. Epiproct triangular, apex rounded; dorsal surface slightly curved from base to apex. Cerci very thin-cylindrical, moderately curved, apex spinose (fig. 143). Subgenital plate transverse, in midline with a membranous fold, apical margin subtruncate or slightly concave and on each apical angle prolonged into a long spinose projection (fig. 99). Gonangulum of ovipositor with a short obtuse ventro-apical projection pointing ventrad.

Coloration: Green. Pronotum with narrow, dark, lateral bands accompanied by dark dots. Tegmen with black dots and with two rows of spaced larger dots in radial areas. In male, tegmen with dorsal area brown. Anterior femur with black spots around spines on ventral edges.

Measurements (length in mm): Body ♂ 17, ♀ 27; pronotum ♂ 4.5, ♀ 4.5; tegmen ♂ 35.0 (broken), ♀ 39.0; tegmen width ♂ 6.0, ♀ 7.0; postfemur ♂ 23.0, ♀ 25.0; ovipositor 7.5.

Etymology. – The name of the new species is chosen from the type locality, Lake Maninjau in West Sumatra.

Elimaea (Rhaebelimaea) modiglianii sp. n.
(figs. 12-13, 31, 72, 89, 102, 132, 140)

Holotype ♂: Indonesia, Sumatra, Si - Rambe, xii.1890 - iii.1891, E. Modigliani, MCSN. – Paratypes: Indonesia: 2♂, Sumatra, Si - Rambe, xii.1890 - iii.1891, E. Modigliani, MCSN; 1♀, Balighe, x.1890 - iii.1891, E. Modigliani, MCSN.

Description. – Fastigium verticis narrow, sulcate, apex obtuse, step-like declined to fastigium frontis. Pronotum with disc narrow, subparallel-sided, surface nearly flat, in anterior area rounded; lateral angles rounded into paranota, apical area shouldered; transverse sulcus V- or Y-shaped; paranota slightly longer than high in male or about as long as high in female; ventral margin rounded, humeral sinus present. Tegmen surpassing hind knees; anterior margin convex, posterior margin substraight; radius sector branching slightly behind middle of tegmen. Anterior femur with dorsal margins angular, with spines on both ventral margins, those on internal side sitting on dark brown spots; meso- and postfemora with spines on ventro-external margin only (in the female with a single spine also on ventro-internal margin of postfemur). Knee lobes of all femora bispinose, but the ventral spine often smaller and occasionally absent (especially on external side of postfemur). Anterior tibia with dorsal and ventral, external and internal, apical spurs; dorso-internal spur smaller and occasionally absent.

Male: Stridulatory vein widened and greatly bulging on dorsal side. Stridulatory file step-like declined before middle (after about 22 teeth), teeth large and wide before the step; the step includes about 7 teeth; behind the step with about 62 - 67 teeth which are becoming smaller and denser towards apex (figs. 12-13). Tenth abdominal tergite transverse with apex subtruncate. Epiproct long tongue-shaped, apex triangularly rounded, with a broad and shallow furrow in basal area. Cerci rather regularly curved; apical area narrow-spatulate, apex acute (fig. 31). Subgenital plate strongly curved dorsad behind middle of length; with a weak medial carina; apical area roundly excised, with lobes narrowly spaced and subparallel, apex of lobes transversely truncate (fig. 72); divided apical area provided with long hair on dorsal, internal and lateral surfaces. Phallus with two elongate conchate sclerites (fig. 89).

Female: Tenth abdominal tergite with apical margin subtruncate. Epiproct tongue-shaped, apex broadly subtruncate. Cerci rather stout, regularly curved and narrowed to apex, apex subobtuse (fig. 140). Subgenital plate short, much wider than long, with a weak median keel; apico-lateral angles acute-triangularly projecting; central part of apical margin subsinuate (fig. 102). Gonangulum of ovipositor with a short, obtuse, ventral projection (fig. 132).

Coloration: Probably green when alive; specimens at hand pale brown (discoloured during previous storage in alcohol). Pronotum with narrow black bands bordering disc and some dark dots on paranota below those bands. Tegmen with dorsal field (including stridulatory area) dark brown, but veins and veinlets pale; stridulatory vein black; with aggregations of dark dots in cells of cubital area and single dark dots in some cells of medial area.

Measurements (length in mm): Body ♂ 14-16, ♀ 19; pronotum ♂ 4.0, ♀ 4.0; tegmen ♂ 33-36, ♀ 32; postfemur ♂ 23.0-26.0, ♀ 22.0; ovipositor 5.8.

Etyymology. – The name of this species is given after the collector, Dr. E. Modigliani.

Elimaea (Rhaebelimaesa) transversa Ingrisch
(figs. 98, 133, 141)

Rhaebelimaesa [sic] *transversa* Ingrisch, 1990a: 91, fig. 3-6.
Holotype ♀: Thailand, Chanthaburi prov., Khao Soi Dao, 15.x.1985, SMF [examined].

Material examined. – 1 ♀, Thailand, Chanthaburi prov., Khao Soi Dao, 12.vi.1988 (CI); 1 ♀, Chanthaburi prov., Pong Nam Lorn, 30.iv.1959, Pai San (DAB, Lot 2506).

Measurements of female (length in mm): Body 22-23; pronotum 4.0-4.8; tegmen 34.0-35.0; tegmen width 7.0-7.5; postfemur 23.5-24.0; ovipositor 7.0-7.5.

Remarks. – The species is already sufficiently described in Ingrisch (1990a). It was previously only known from the holotype. New material available includes two females; thus the male is still unknown. The diagnostic characters are outlined in the key.

Elimaea (Rhaebelimaesa) pseudochloris sp. n.
(figs. 9, 36, 73, 93, 161)

Holotype ♂: Thailand, Trang prov., Khao Chong, 23.x.1991, at light, S. Ingrisch, DAB.

Description. – Fastigium verticis narrow, sulcate, apex obtuse, step-like declined to fastigium frontis. Pronotum with disc nearly flat and with a distinct medial carina which is subobsolete in posterior area; paranota longer than high, ventral margin subsinuate and angles rounded, humeral sinus distinct. Anterior femur with spines on both ventral margins, meso- and postfemur with spines on ventro-external margin. Knee lobes of all legs uni- or bispinose (irregular). Anterior tibia with dorsal and ventral, external and internal, apical spurs. Tegmen surpassing hind knees, anterior margin distinctly convex, posterior margin faintly concave, substraight; radius sector branching in basal half, distinctly before middle of tegmen.

Male: Stridulatory file with circa 32 teeth which are rather large and almost equally sized and equally spaced

throughout (fig. 9). Tenth abdominal tergite with apical margin subtruncate (faintly concave). Epiproct long tongue-shaped. Cerci narrow-cylindrical, strongly curved but substraight at base; apex terminating in a long twisted cone with acute apex (fig. 36). Subgenital plate with a short bowl-shaped basal part and a long, curved, apical part which is parallel-sided and split from apex for slightly less than half of its length (fig. 73); resulting lobes armed with numerous spinules on medial surfaces. Phallus with large semi-cylindrical projections which are terminating in mussel-shaped sclerites with apical margin finely serrulate (fig. 93).

Female unknown.

Coloration: Green; pronotum, legs and body with black dots. Pronotum with a yellow medio-longitudinal band; abdominal tergites red in middle.

Measurements of male (length in mm): Body 20; pronotum 4.0; tegmen 29.5; tegmen width 5.5; postfemur 21.5.

Etyymology. – The name of this species is given for its superficial similarity with *E. chloris*.

Elimaea (Rhaebelimaesa) apicata sp. n.
(figs. 4, 37, 74, 91, 154)

Holotype ♂, Thailand, Surat Thani province, Khao Sok, 150m, 23.i.1997, S. Ingrisch, DAB.

Description. – Fastigium verticis narrow, dorsally furrowed; in lateral view slightly sinuate; step-like declined to fastigium frontis. Pronotum with disc flattened, with indication of lateral carinae and rounded-angularly bent into paranota; lateral margins subparallel, only at apex slightly diverging; anterior margin slightly concave, posterior margin rounded but somewhat constricted in middle; transverse sulcus short Y-shaped, with indication of a short medial carinula before apex; paranota slightly longer than high (1.1x); ventro-posterior angle broadly rounded, humeral sinus distinct. Tegmen with anterior area faintly widened in basal half, with almost subparallel margins, apex rounded; radius sector branching in about middle (15 mm from base). Anterior femur distinctly compressed with spines on both ventral margins. Meso- and postfemur with spines on ventro-external margin. Genicular lobes of all legs bispinose. Tibial tympana conchate but leaving a rather large proportion of the tympana uncovered. Anterior tibia with dorsal and ventral, external and internal apical spurs.

Male: Stridulatory file with circa 90 rather dense teeth which gradually become narrower from base to apex (fig. 4). Tenth abdominal tergite largely prolonged behind and divided into two rounded lobes in apical third. Epiproct tongue-shaped, covered by the projection of tenth tergite. Cerci long, in basal area substraight, afterwards strongly curved, apical area

compressed and terminating in a long-triangular, acute cone (fig. 37). Subgenital plate with quickly approaching lateral margins in basal area, central area attenuate and prolonged, gently curved and sub-parallel-sided, only at apex very faintly excised; basal part with a medial carina that runs to about half of the attenuate central projection (fig. 74). Phallus with a pair of elongate, sclerotised, conchate projections with serrate dorsal margin (fig. 91).

Female unknown.

Coloration: Green. Body and legs with black and red dots. Antenna brown on dorsal, light on ventral side, in posterior area blackish-brown with largely spaced white rings. Pronotum with lateral carinulae whitish, bordered on both sides by a band of black dots. Tegmen green, dorsal field black but with stridulatory vein, a large spot at end of stridulatory area and veinlets light brown; lateral area with 2 rows of large black dots (between subcosta and anterior margin and between radius and media) and with aggregations of small black dots in cells between radius and anal margin.

Measurements of male (length in mm): Body 22; pronotum 3.8; tegmen 31.5; tegmen width 4.8; anterior femur 7.5; mesofemur 11.5; postfemur 22.5.

Etymology. – The name of this species refers to the prolongation of the last abdominal tergite.

Elimaia (Rhaebelimaia) sinuata sp. n.
(figs. 5, 30, 71, 90, 162)

Holotype ♂: Indonesia, Mentawai exp., H.H. Karny, Sipora no. 195, 21.x.1924, MZB.

Description. – Fastigium verticis narrow, furrowed above; step-like declined to fastigium frontis. Pronotum with disc nearly flat especially in posterior area, angles rounded, anterior margin concave, posterior margin rounded, transverse sulcus V-shaped; paranota circa as long as high, humeral sinus present. Tegmen surpassing hind knees, sub-parallel-sided but faintly curved throughout, apex rounded; radius sector branching slightly before middle; transverse veinlets rather regular, especially in anterior area and between radius and radius sector. Anterior coxa with a minute spinule. Anterior femur with one spinule on both ventral margins, meso- and postfemur with several spinules on ventro-external margins. Knee lobes of all femora bispinose. Tympana conchate on both sides, but leaving the anterior part of the tympanum uncovered. Anterior tibia with dorsal and ventral, external and internal, apical spurs. Posttibia with one dorsal and two ventral apical spurs on both sides.

Male: Stridulatory file sinuate, with about 10 large, widely spaced teeth in circa basal half and narrow, dense teeth in apical half; together about 52 teeth (fig.

5). Cerci long-cylindrical, rather moderately curved, apex slightly bulbous and with a large, compressed, curved, subacute cone (fig. 30). Subgenital plate bowl-shaped, regularly curved throughout, split until base, apex terminating in two narrow, parallel, subacute, stylate projections (fig. 71). Phallus with a pair of wedge-shaped sclerites with slightly rounded apical margin curved ventrad and serrulate; and ventral of sclerites with an unpaired stylate projection which is slightly curved and has angular margins, dorsal angles armed with spines (fig. 90).

Female unknown.

Coloration: Yellowish brown, probably green when alive. Pronotum with interrupted bands of spots and dots along lateral angles. Tegmen with a row of dark spots in radial area.

Measurements of male (length in mm): Body 19; pronotum 4.8; tegmen 35.0; tegmen width 5.5; postfemur 26.0.

Etymology. – The name of this species refers to the sinuate course of the stridulatory file.

Elimaia (Rhaebelimaia) pentaspina sp. n.
(figs. 101, 124, 134, 142)

Holotype ♀: Thailand, Chanthaburi prov., Khao Soi Dao, 19.xii.1974, A.Lewvanich, DAB (Lot 3697). – Paratype: 1 ♀, Thailand, Chanthaburi prov., Khao Soi Dao, 12.vi.1988, CI.

Description. – Fastigium verticis narrow, sulcate, apex obtuse and step-like declined to fastigium frontis. Pronotum with disc broadly rounded but posterior area nearly flat and shouldered, lateral angles rounded; anterior margin concave in middle, posterior margin rounded; transverse sulcus Y-shaped, behind middle of pronotum; paranota longer than high, ventral margin rounded, humeral sinus weak. Tegmen surpassing hind knees; radius sector branching slightly before middle of tegmen. Anterior femur phasmid-like curved but curvature weak, almost straight. Anterior femur with spines on both ventral margins, meso- and postfemur with spines on ventro-external margin. Knee lobes of all femora bispinose. Anterior tibia with dorsal and ventral, external and internal, apical spurs.

Male unknown.

Female: Tenth abdominal tergite with apical margin subtruncate. Epiproct long tongue-shaped. Cerci long-conical, curved, apex obtuse (fig. 142). Subgenital plate with a compressed lateral projection at each side; apical margin with a long spinose projection at each angle and area in between short, obtuse-angularly projecting (fig. 101). Gonangulum of ovipositor with a long, conical, ventro-apical projection; ventral ovipositor valves with a triangular projection with obtuse apex just below projection of gonangulum (figs. 124, 134).

Coloration: Green; abdomen with red dots. Pronotum with black dots especially around lateral angles. Tegmen with a longitudinal band of black dots in medial area and some dots in other fields.

Measurements of female (length in mm): Body 21-23; pronotum 4.0-4.8; tegmen 34.0-34.5; tegmen width 6.0; postfemur 24.0-25.0; ovipositor 6.5-6.8.

Etymology. – The name of this species refers to the subgenital plate with its 5 (2 lateral and 3 apical) projections.

Elimaea (Elimaea) Stål

Elimaea Stål, 1874: 27. Type species: *Phaneroptera subcarinata* Stål, 1861; by monotypy.

Diagnosis. – *Elimaeni* with anterior femora curved as in phasmids. Tibial tympana covered by a conchate fold on both sides. Greatest width of tegmen wider than length of pronotum; radius sector branching distinctly before middle of tegmen. Phallus membranous. Ovipositor falcate, dorsal margin serrulate in circa apical half, ventral margin in apical area; gonangulum with ventro-apical angle projecting.

Distribution. – The typical subgenus *Elimaea* has its greatest species diversity in China and Indochina, while from the Malay Peninsula to western Indonesia there is only a single species (except for the *poaeformis*-group). The known range spreads from the Southern Maritime Territory of Russia in the north to Java in the south, and from Taiwan in the east to North-East India (West Bengal) in the west (map 1). There are records of a few species with doubtful subgeneric affinity from Bombay and Sri Lanka. Thus the range of the subgenus might also cover the Indian subcontinent. Species of the nominate subgenus are often found in secondary vegetation, although they can intrude into forests along roads and clearings.

Elimaea (Elimaea) subcarinata (Stål) stat. rev.

(figs. 20-23, 45-47, 59-60, 65, 112-113, 128, 146-147, 158, 163, 164-165, map 3)

Phaneroptera subcarinata Stål, 1861: 319. Syntypes 1♂, 1♀: China, Hongkong, NRS [examined].

Elimaea chloris (nec De Haan, 1842) Brunner 1878: 100 (partim); Karny 1926a: 36 (partim).

Elimaea appendiculata Brunner, 1878: 101. Holotype ♂: Indochina, Thorey, NHMW (coll. Brunner no. 5503) [examined]. *syn. n.*

Elimaea punctifera (nec Walker, 1869) Kirby 1906 (partim): 396; Uvarov 1927: 95 (partim).

Material examined. – Thailand: 1♂, 1♀, Chiang Mai prov., Phrao district, Phrao - Ban Pradu, 26.-29.ix.1985; 1♂, 1♀, Lampang prov., Doi Khun Tan, 900m, 16/17.ix.1993 at night; 26♂, 24♀, same data but ex ovo; 1♂, Tak prov., Mae Salid, Monkhrating, 700m, 18./19.v.1988;

1♂, Nakhon Ratchasima prov., Khao Yai, 1./2.x.1985, all ci. – India: 1♂, West Bengal, Jalpaiguri, 18.xii.1986, R.S. Barman; 1♂, 1♀, Mizoram, Teirei, Aizaul, 13.xi.1995, M.S. Shishodia, all zsi.

Description. – Fastigium verticis narrow, apex subacute, dorsal surface furrowed. Pronotum with disc flattened, especially in posterior area, lateral angles rounded; transverse sulcus Y-shaped, slightly behind middle; anterior margin concave, posterior margin rounded; paranota longer than high (51:40 and 55:49 in syntypes of *E. subcarinata*, 56:48 in type of *E. appendiculata*); ventral and posterior margins rounded; humeral sinus distinct. Tegmen surpassing hind knees; radius sector branching circa 8-10 mm from base. Anterior femur with spines on both ventral margins (on external side smaller). Meso- and postfemora with spines on ventro-external margin. Genicular lobes of all legs bispinose. Anterior tibia with external and internal, dorsal and ventral apical spurs (dorso-internal spine lacking on one fore leg of both syntypes of *E. subcarinata*).

Male (syntype of *E. subcarinata*): Stridulatory file (damaged) with 8 large to medium sized teeth and a few indistinct minute teeth (fig. 20). Tenth abdominal tergite with apex broadly rounded; central area setose and with a small puncture in middle. Epiproct tongue-shaped, apex obtuse. Cerci strongly curved; apical area compressed, sinuate and external side convex, internal concave, with narrowing margins and apex subacute on dorso-cranial side (fig. 45). Subgenital plate moderately curved dorsad (almost straight behind basal area); split into two obtuse lobes in circa apical third (fig. 65).

Male (type of *E. appendiculata*): Stridulatory file with 8 large and 3 minute teeth (fig. 21). Tenth abdominal tergite entire (shrunk due to previous storage in alcohol), central area setose. Epiproct tongue-shaped with a weak medial carina. Cerci strongly curved; apical area compressed, sinuate and external side convex, internal concave, with narrowing margins and apex acute on dorso-cranial side (fig. 46). Subgenital plate damaged.

Male (specimens from Thailand): Stridulatory file with 6-8 large and 2-11 minute teeth (fig. 22-23). Tenth abdominal tergite with apex broadly rounded; central area setose and with a small puncture in middle. Epiproct tongue-shaped, apex obtuse. Cerci strongly curved; apical area compressed and twisted, with narrowing margins; apex varying from acute (on dorso-cranial end) to subobtuse (fig. 47). Subgenital plate moderately curved dorsad; split into two obtuse lobes in circa apical third (figs. 59-60).

Female: Tenth abdominal tergite with apex subtruncate. Epiproct triangular, apex obtuse. Subgenital plate acute-triangular, apex angularly excised and with 2 short triangular lobes (figs. 112-113). Cerci regularly and rather strongly curved; apex subacute to subobtuse (fig. 146, 147). Gonangulum of ovipositor with a large,

bulbous, ventro-apical appendage which in situ lies in a cleft between dorsal and ventral valves (fig. 128).

Coloration: Syntypes of *E. subcarinata*: Discolored, but probably green when alive. Antenna with scapus and pedicellus concolorous, flagellum blackish brown on dorso-lateral side (with antenna directed posteriorly), ventro-internal side light brown. Disc of pronotum in male with a brown medial band which is split by a white line, in female green with the white line only. Tegmen in cells between radius and anal margin with aggregations of black dots, less distinct between radius and media.

Type of *E. appendiculata*: Discolored, but probably green when alive. Antenna with scapus and pedicellus concolorous, flagellum dark brown especially on dorso-lateral side (with antenna directed posteriorly). Tegmen in cells between media and anal margin, in apical half also in cells between radius and media with aggregations of black dots.

Variation of specimens from Thailand:

(1) Green. Compound eyes brown. Scapus and pedicellus reddish brown, flagellum black in basal area, with or without annulation, otherwise with spaced light rings. Vertex and disc of pronotum with a brown medial band. Tegmen green, anterior margin orange or red, anal margin darkened (cells black, veinlets green). Abdominal tergites red in middle; anterior and medial legs orange brown.

(2) as before but general colour yellowish brown (this colour variant appeared while breeding the species in laboratory). Antenna as described under (1) or light brown with spaced dark rings.

(3) as (1) but dorsal area of tegmen distinctly darkened.

(4) as (3) but anterior area of tegmen with a red pattern; hind legs brownish.

(5) almost uniformly green (or yellowish brown); flagellum of antenna only slightly infumate at base especially on dorsal side (with antenna directed posteriorly); vertex and pronotum without dark medial band; tegmen green with the dark dots little conspicuous.

Measurements of syntypes of *E. subcarinata* (length in mm): Body ♂ 16, ♀ 22; pronotum ♂ 4.2, ♀ 4.9; tegmen ♂ 29.0, ♀ 32.0; tegmen width ♂ 4.7, ♀ 5.8; anterior femur ♂ 7.5, ♀ 9.0; mesofemur ♂ 10.0, ♀ 10.0; postfemur ♂ 22.0, ♀ 25.0; ovipositor 6.8.

Measurements of male type of *E. appendiculata* (length in mm): Body 21; pronotum 4.5; tegmen 37.0; tegmen width 6.0; anterior femur 9.5; mesofemur 12.0; postfemur 26.0.

Measurements of specimens from Thailand (length in mm). – Body ♂ 21–28, ♀ 22–27; pronotum ♂ 4.0–4.5, ♀ 4.2–4.8; tegmen ♂ 35.0–40.0, ♀ 35.0–38.0; tegmen width ♂ 5.5–6.0, ♀ 5.5–6.0; anterior femur ♂ 9.0–10.0, ♀ 9.5–10.0; mesofemur ♂ 11.0–12.5, ♀ 11.0–13.0; postfemur ♂ 23.0–27.5, ♀ 23.5–

27.5; ovipositor 6.5–7.0.

Remarks. – Males of *E. subcarinata* are easily recognisable by the low number of large and widely spaced stridulatory teeth on the underside of the left tegmen. The additional minute teeth at the apex which vary in number and which are sometimes absent are certainly not used for stridulation and as such do not underlie a selective pressure. The differences of the stridulatory files show with certainty that *E. subcarinata* is not a synonym of *E. chloris* as supposed by Brunner (1878), and *E. appendiculata* not a synonym of *E. punctifera* as supposed by Kirby (1906).

The male syntype of *E. subcarinata* is rather small compared with the series of specimens from Thailand and with the type of *E. appendiculata*. Small differences in the male cerci might be attributed to this fact. The stridulatory file does not show any significant differences between the specimens of different origin. Thus there is no doubt that they are conspecific, and *E. appendiculata* is a synonym of *E. subcarinata*.

Development. – Oviposition was in parenchyma of leaves (*Rubus*), but also between the layers of absorbent paper and in polystyrene. The eggs are compressed kidney-shaped as typical for Phaneropterinae. Egg development required 28–42 (mean 35) days at 25°C and 39–105 (mean 64) days at 20–23°C. There are 6 larval instars. The first instar larvae are green with 3 white longitudinal stripes which are very conspicuous (fig. 165). The femora are olivaceous at base, otherwise legs and antennae are yellowish brown. Larval development (from hatching to adult) required 45–49 days at 25°C and 71–86 days at 20–23°C. The spermatophore is very large (fig. 164). In captivity, the species fed readily on European plants as *Rumex*, *Plantago*, and seedlings of sunflower, and less readily on wheat, *Rubus*, and *Cirsium*.

Stridulation (fig. 173). – The songs of two males bred from the egg from Doi Khun Tan (Lampang province, Thailand) was recorded at 24°C and 26°C. Stridulation consists of loose groups of 1–3 syllables. The groups are repeated at irregular intervals. Syllable duration varied between 18–35 ms at 24°C or 15–26 ms at 26°C. It was thus similar to the syllable duration in *E. chloris*. However the syllables consisted of only 4–6 pulses which were longer than in *E. chloris* and not well separated from each other. Stridulation was loudest at about 12–18 kHz. The sound of a syllable can be circumscribed as “zip”.

Elimaea (Elimaea) chloris (De Haan)

(figs. 18–19, 42–43, 63–64, 83, 111, 120, 127, 148, 157, map 3)

Locusta (Phaneroptera) *chloris* De Haan, 1842: 192. Syn-types (2♂, 1♀): Java, RMNH [examined]. – *Elimaea chloris* Brunner 1878: 100 (partim); Karny 1926a: 36, fig. 96 (partim); Karny 1926b: 265, fig. 185.

Material examined. – Indonesia: 1 ♂, West Java, Palabuan Ratu, ii.1921, H.H. Karny, SMF; 1 ♀, West Java, Bogor, Kebun Raya, 15.ii.1995; North Sumatra, Pematang Siantar, 400m, 4.iii.1993. – Malaysia: 1 ♀, Pahang, Taman Negara, Kuala Tahan, 19.-22.vii.1984; 1 ♀, Pahang, Rantau Abang, 23.-25.vii.1984. – Thailand: 1 ♂, Bangkok, Lard Phrao, 5.-8.vi.1988; 1 ♂, Surat Thani prov., Khao Sok, 150m, 24.i.1997; 1 ♀, Surat Thani prov., Koh Samui, Lamai beach, 10.x.1985; 2 ♀, do., Na Muang Falls, 25.ix.1989; 1 ♀, Prachuap Khiri Khan prov., 45 km west of Hua Hin, 12.ix.1993, all ci.

Description. – Fastigium verticis narrow, dorsally furrowed; step-like declined to fastigium frontis. Pronotum with disc flattened, especially in posterior area, lateral angles rounded into paranota; transverse sulcus V-shaped; with a faint indication of a medial carinula; paranota longer than high (54:45), ventral and posterior margins together broadly rounded; humeral sinus distinct. Tegmen with radius sector branching between 5.5 and 11.5 mm from base of tegmen. Anterior femur with spines on both ventral margins, on external side sometimes absent or only one spine; meso- and postfemora with spines on ventro-external margin; genicular lobes of all legs bispinose. Anterior tibia with dorsal and ventral, external and internal apical spurs.

Male: Stridulatory file with circa 32-35 teeth which are large and very widely spaced in circa basal half, gradually decreasing in size in third quarter and terminating in a series of minute teeth in apical quarter (figs. 18-19). About 14-16 teeth may be regarded as large and useful for sound production; the minute teeth at apex are probably without function. Tenth abdominal tergite slightly prolonged behind, apex truncate; central area setose and with a distinct puncture in middle. Epiproct long tongue-shaped; apex subtruncate. Cerci curved, widest in basal area, slightly narrowing in middle and slightly widening again towards apex; apical area compressed and twisted-triangular, very apex acute and curved cephalad (figs. 42-43). Subgenital plate narrow, only slightly curved, split into two parallel lobes in apical quarter to apical third (37:93 - 20:82) (figs. 63-64, 83).

Female: Tenth abdominal tergite short, transverse with a distinct puncture in middle. Epiproct long tongue-shaped, apex short-acutely projecting in middle. Cerci moderately curved, apex subacute (fig. 148). Subgenital plate long-triangular, apex short-roundly excised (fig. 111). Gonangulum of ovipositor with a large, semimembranous, ventro-apical appendage (figs. 120, 127).

Coloration: Green with or without a brown longitudinal band on vertex, disc of pronotum and dorsal area of tegmen (or part of these organs); compound eyes brown; antenna concolorous or dorsal side of flagellum infumate (antenna directed anteriorly), scapus and pedicellus with or without some reddish pattern.

Tegmen with more or less distinct aggregations of dark dots in the cells mainly in apical half of tegmen and between radius and cubitus. Abdominal tergites often reddish brown in middle and with or without some reddish dots in lateral areas.

Measurements (length in mm): Body ♂ 22-23, ♀ 20-25; pronotum ♂ 4.2-4.5, ♀ 3.8-4.5; tegmen ♂ 33.0-35.0, ♀ 30.5-37.0; tegmen width ♂ 5.5 - 6.2, ♀ 5.5-6.0; anterior femur ♂ 7.5-8.0, ♀ 7.5-8.0; mesofemur ♂ 9.5-10.5, ♀ 9.0-10.5; postfemur ♂ 21.0-23.0, ♀ 20.0-22.5; ovipositor 6.0-7.0.

Remarks. – The species was previously thought to be widespread in the Oriental Region (Brunner 1878, Karny 1926a, Jin & Xia 1994). However of the material at hand, only specimens from Central and Southern Thailand, Malay Peninsula, Sumatra and Java can be attributed to this species. The occurrence in other regions has to be verified.

Stridulation (fig. 172). – The song of one male from Lard Phrao (Bangkok, Thailand) was recorded in the field during the night (temperature not measured but supposed to be about 25-28°C). Stridulation consists of echemes of 2-3 crescendoing syllables. The echemes can be rather regularly repeated for several minutes. Syllable duration varied between 15-29 ms, echeme duration between 381-393 ms in the two-syllabic and 1012-1318 in the three-syllabic echemes. About ten single pulses can be recognised in the syllables at a high time resolution. The song was loudest at 10-15 kHz but higher frequencies were not recorded with the field equipment. The sound of an echeme can be circumscribed as “zip zip zip”.

Elimaea (Elimaea) punctifera (Walker)
(figs. 26, 44, 61-62, 82, 160)

Phaneroptera punctifera Walker, 1869: 342. Holotype (♂): Bangladesh: Silhet (BMNH) [examined]. – *Elimaea punctifera* Kirby 1906: 396; Karny 1926c: 23.

Redescription of holotype. – Fastigium verticis narrow, acute-angular in dorsal view with apex subacute, dorsal surface furrowed. Pronotum with disc flattened in posterior area, lateral margins rounded; transverse sulcus slightly behind middle, V-shaped; paranota longer than high (4:3); ventral and posterior margins rounded together; humeral sinus distinct. Tegmen surpassing hind knees; radius sector branching circa 8 mm from base. Legs I and II absent. Postfemur with spines on ventro-external margin. Hind knees bispinose.

Male: Stridulatory file with about 53 teeth which are large and spaced in basal half and gradually becoming narrower and denser towards apex (fig. 26). Tenth abdominal tergite slightly prolonged and apex subtruncate. Epiproct long tongue-shaped. Cerci rather strongly curved, centre of curvature slightly before middle; apical area spatulate, rather long and

step-like constricted against rest of cercus, with convex external and concave internal surface, very apex curved ventrad and subacute (fig. 44). Subgenital plate narrow, rather strongly curved dorsad (artefact?), with a weak medial carina, apex split in circa apical quarter (figs. 61-62, 82).

Coloration: Rather uniformly green. Tegmen in cells between media and cubitus and in apical half of tegmen also in cells between radius and media with aggregations of black dots; internal margin of tegmen brownish.

Measurements of male (length in mm). Body 21; pronotum 4.5; tegmen 36.0; tegmen width 6.0; post-femur 27.0.

Remarks. — *E. punctifera* is a rather uniformly green coloured species without striking characters. The dark colour pattern caused by the black dots in the cells of the tegmina are not as striking as described in the key in Karny (1926a). Moreover, the subgenital plate is not so strongly divided at the apex as supposed by previous authors (Tinkham 1943, Bei-Bienko 1955). Thus both authors probably misidentified other species as *E. punctifera*. Only the apical quarter of the subgenital plate is divided which is the same value as in *E. chloris*. The subgenital plate as well as coloration which were previously thought to differ between both taxa, are thus not distinctive. Both species are very similar. They differ however strikingly in the number of stridulatory teeth on the underside of the left tegmen and less strikingly in the length of the cerci and the shape of the apical area of the cerci.

E. punctifera was previously thought to be widespread in the Oriental Region (Kirby 1906, Yin & Xia 1994) and adventive to the Hawaiian fauna (Hebard 1922b). However the material that I have seen from Indochina and Hawaii is not conspecific with the holotype. Thus the species is with certainty only known from the type locality Silhet in Bangladesh. Its' distribution is probably restricted to the Indian subcontinent or to an even smaller range. The occurrence in other regions has to be verified.

Elimaea (Elimaea) thaii sp. n.

(figs. 24-25, 48, 57-58, 110, 129-130, 149-150, 156, 166, map 3)

Holotype ♂: Thailand, Tak prov. Mae Salid, Monkrating, 700m, 19.-21.v.1988, S. Ingrisch, DAB. — Paratypes: Thailand: 1♀, Tak prov. Mae Salid, Monkrating, 700m, 16.v.1988 (600-800m); 1♂, same data, 19.-20.ix.1989; 2♂, same data, 11.-13.x.1990; 1♀, same data, 31.vii.1992; 2♂, same data, 1.viii.1992 (700-1000m); 1♂, Tak prov., Doi Musoe, Agricultural Research Station, 9.x.1990; 1♂, Tak prov., Umphang, 16.x.1991; 1♂, 3♀, Chiang Mai prov., Doi Chiang Dao, 4.-7.vi.1986; 1♀, same data,

9.x.1991; 1♂, 1♀, Chiang Mai prov., Phrao district, Phrao - Ban Pradu, 26.-29.ix.1985; 1♀, Chiang Mai prov., 10 km NE Samoeng, 10.x.1991; 1♂, 1♀, Chiang Mai prov., 5 km SE Samoeng, 4.vi.1997 ex larva; 11♂, 5♀, same data but ex ovo; 1♀, Chiang Mai prov., Doi Suthep, 13-1400m, 8.x.1991; 2♀, same data, 3.ii.1997 ex larva; 1♀, Mae Hong Son prov., Samoeng - Pa Pae (Karen village - Kunsan Nai), 30.iv.1988; 1♀, Mae Hong Son prov., Pai - Soppong, 24.-26.i.1987, all cr.

Description. — Fastigium verticis narrow, dorsally furrowed, apex subacute. Pronotum with disc flattened in posterior area, lateral angles rounded; transverse sulcus short Y-shaped, slightly behind middle; paranota about 1.1-1.2x longer than high; ventral and posterior margin rounded together; humeral sinus distinct. Tegmen surpassing hind knees; radius sector branching circa 7.5-12 mm from base.

Male: Stridulatory file with circa 34-42 teeth which are large and somewhat spaced from each other in basal half and gradually becoming narrower and denser towards apex (figs. 24-25). Tenth abdominal tergite with apical margin broadly rounded; central area setose and with a distinct puncture in middle. Epiproct long tongue-shaped. Cerci rather short, strongly curved; apical area short, compressed and twisted, slightly curved, apex acute (fig. 48). Subgenital plate narrow, split for slightly less than apical half (apical four to five tenths) (figs. 57-58). Dorso-central surface of medial phallus valves covered with warts.

Female: Tenth abdominal tergite with apex subtruncate or slightly concave; with a distinct puncture in the middle. Epiproct long-triangular, apex subobtusate (figs. 149-150). Cerci moderately curved, slender; apex varying from subacute to obtuse. Subgenital plate long-triangular in general outline with a medial furrow bordered by a carina at each side; apex subtruncate between two slightly projecting lateral angles (fig. 110). Gonangulum of ovipositor with ventro-apical appendage smaller than in *E. subcarinata* and *E. chloris* (figs. 129-130).

Coloration: Male green; compound eyes brown; antenna (stretched anteriorly) light brown on dorsal, dark brown to black on ventral surface, with spaced annulation; disc of pronotum with dark dots and with a narrow brown medial band which is interrupted in middle by a fine white line. Tegmen with aggregations of black dots in cells between media and anal margin and in apical half of tegmen also between radius and media. Abdominal tergites red in middle.

Variation: The brown band on pronotum sometimes indistinct or absent and leaving only the white line and eventually a pair of irregular white lateral lines present. The dark brown band may also extend to the vertex and the dorsal area of the tegmen. In

darker individuals, the anterior and medial legs are often brownish or pale reddish brown and the anterior margin of the tegmen reddish. The pronotum can be with or without red dots and the anterior area of the stridulatory field can be red.

Female varying from uniformly green (rarely brown when alive) to very colourful. Head, antenna and pronotum as in male. Pronotum with or without dark brown or red dots; with or without a brown medial band that is split by a fine white line (may be extended to vertex or not); with or without irregular white lateral lines. Tegmen green with aggregations of black dots in cells between radius and anal margin varying from hardly expressed to very distinct, may also be replaced by red dots; or cells between radius sector and cubitus almost completely red and only the veins green; or almost all of tegmen, body, and legs suffused with red. Abdominal tergites usually red in middle. Legs as in male; genicular region of anterior leg (femur and tibia) often, but not always darkened.

Measurements (length in mm): Body ♂ 16-25, ♀ 20-25; pronotum ♂ 3.5-4.2, ♀ 3.5-4.2; tegmen ♂ 32.0-36.5, ♀ 31.5-37.0; tegmen width ♂ 5.0-6.0, ♀ 5.0-6.0; anterior femur ♂ 7.5-9.0, ♀ 7.5-9.0; mesofemur ♂ 9.5-12.0, ♀ 9.5-11.0; postfemur ♂ 21.0-25.0, ♀ 20.0-24.5; ovipositor 6.0-6.5.

Remarks. — Part of the material of this species was previously misinterpreted as belonging to *E. punctifera* by Ingrisch (1990a). The stridulatory file and the male cerci show however distinct differences to the male holotype of *E. punctifera*. A large number of specimens in the DAB from numerous localities in Thailand which were partly identified as *E. chloris* by the late Dr. H.H. Karny probably also belong to this species or to *E. subcarinata*; the stridulatory file was, however, not checked.

The male subgenital plate of *E. thaii* is also similar to that of *E. berezovskii* Bei-Bienko, 1951, described from the Sichuan province in China. Both species differ in the width of the tegmen which is 5.1-5.3 times longer than wide in *E. berezovskii* (Bei-Bienko 1965), but 6-7 times longer than wide in *E. thaii*. Other diagnostic characters are not well described for *E. berezovskii*, especially the stridulatory file is unknown.

E. thaii is common in western and northern Thailand, where it can occur in the same habitat together with *E. subcarinata* (map 3).

Etymology. — The name of this species refers to its distribution.

Development. — Oviposition was in parenchyma of leaves (*Rubus*). Egg development required about 42-64 days at 18-25°C. There are six larval instars. The first instar larvae are green; the longitudinal white stripes are less conspicuous than in the young larvae of *E. subcarinata*. Legs and antennae are yellowish brown. When at rest, they sit as the adults with the

antennae and anterior legs stretched forwards and the posterior legs spread in an acute angle from the body (fig. 166). Several larvae became brown in subsequent moultings, but almost all of them changed back to green with the final ecdysis. Food plants were the same as in *E. subcarinata*.

Stridulation (fig. 174). — Stridulation of one male from Samoeng (Chiang Mai province, Thailand) was recorded at 22.5°C. The male was kept with a female larva and later with an adult female in the same cage. On the latter occasion, the male female response stridulation was also recorded.

Stridulation of the male kept together with the larva consisted of single syllables which were repeated in long and irregular intervals. In a 45 min continuous recording, the male produced only 5 syllables. According to the higher number of stridulatory teeth, syllable duration (122-213 ms) was much longer than in both other *Elimaea* s. str. species.

On a later occasion, when a female answered the males' syllable with a short and quiet click sound, the male produced a second syllable. The female response was 3042-3760 ms after the males' first syllable, while the males' second syllable followed 6400-6915 ms after the females' answer.

The main frequency of the male stridulation was at 8-18 kHz and thus rather loud for the human ear. The sound of a syllable is the same as in the preceding two species, but longer.

Discussion. — Male stridulation of the *Elimaea* and *Rhaebelima* species so far studied is rather simple and is composed of only a few short syllables. The differences in stridulation of the three *Elimaea* species however give evidence that despite of the great morphological similarity they are three distinct species. Moreover, the time pattern of the syllables they produce corresponds with the number of teeth on the stridulatory file. This gives evidence that the stridulatory file is one of the most useful characters in *Elimacini* (especially in *Elimaea* s. str.) and it should be used for taxonomic purpose.

Elimaea (s. str.) *nautica* sp. n.

(figs. 27-28, 49-50, 55-56, 109, 145, map 3)

Holotype ♂: Thailand: Chanthaburi prov., Khao Soi Dao, 29.-31.v.1990, A. Lewvanich, V. Koon-tong, S. Wangsuk, DAB (Lot 4166). — Paratypes: 1 ♂, Thailand, Chanthaburi prov., Khao Soi Dao, 15.x.1985, cl. — USA: 1 ♂, 1 ♀, Hawaii, Big Island, near Kaumana Cave, 7.viii.1993, cl.

Description. — Fastigium verticis narrow, dorsal surface sulcate, in lateral view sinuate; step-like declined to fastigium frontis. Pronotum with disc flattened but lateral angles rounded; transverse sulcus V-

or short Y-shaped; with a short and weak medial carina before apex; anterior margin concave, posterior margin rounded; paranota 1.1x longer than high, ventro-posterior angle rounded; humeral sinus distinct. Anterior femur with spines on both ventral margins (on internal side more than on external); meso- and postfemur with spines on ventro-external margin. Tibial tympana conchate on both sides. Anterior tibia with dorsal and ventral, external and internal apical spurs; dorsal surface sulcate.

Male: Stridulatory file with circa 28-29 teeth which are large and widely spaced from each other (figs. 27-28). Tenth abdominal tergite with apical margin widely rounded; central area setose and provided with a puncture in centre. Epiproct tongue-shaped, apex broadly rounded. Cerci strongly curved, rather short; apical area compressed and excavated on cranial side; tapering towards acute apex (figs. 49-50). Subgenital plate long and narrow, with a medial carinula in basal half; split into 2 subparallel lobes in circa apical half or more (apical five to six tenth); apical lobes setose (figs. 55-56).

Female: Epiproct tongue-shaped. Cerci short, slightly curved, stout in basal area, narrowing in about middle, but then cylindrical and of subequal width to apex; apex obtuse (fig. 145). Subgenital plate long-triangular, apex rather broadly excised in middle, subtruncate between two short obtuse lateral projections (fig. 109).

Coloration: Green. Vertex and disc of pronotum with a faint brown medial band split in middle by a whitish line and with scattered brown dots, lateral angles with a little distinct white line. Tegmen green, anterior margin reddish or anterior area indistinctly infumate, with aggregations of black dots mainly between radius and anal margin.

Variation. In the female at hand, paranota and abdomen with red dots; medial band on disc of pronotum reddish, not split in middle.

Measurements (length in mm): Body ♂ 21-22, ♀ 21; pronotum ♂ 4.2-4.5, ♀ 4.8; tegmen ♂ 36.5-37.5, ♀ 40.0; tegmen width ♂ 5.5-6.3, ♀ 6.0; anterior femur ♂ 9.0, ♀ 10.0; mesofemur ♂ 11.5-12.0, ♀ 12.0; postfemur ♂ 23.0-24.0, ♀ 24.0; ovipositor 8.0.

Remarks. – This species agrees with the description of *E. punctifera* by Bei-Bienko (1955), not Walker (1869). A re-investigation of Walkers' type shows however that both species are quite different.

Material of *E. nautica* at hand was collected in south-eastern central Thailand (map 3). It is possible that its range spread from there to Cambodia and South Vietnam. *E. nautica* is also adventive to the Hawaiian fauna. Whether other *Elimaea* species, e.g. *E. punctifera* as recorded by Hebard (1922b), also occur on the Hawaiian Islands was not investigated.

Etyymology. – The name of this species is derived from Latin "nauticus" = seaman. It refers to its ability to cross the ocean and become an adventive species in Hawaii.

Elimaea poaeifolia-group

Type species: *Locusta (Phaneroptera) poaeifolia* De Haan, 1842; here designated.

Diagnosis. – Elimaeini with anterior femora curved as in phasmids. Tibial tympana covered by a conchate fold on both sides. Width of tegmen in middle slightly narrower than length of pronotum in male or width subequal to length of pronotum in female; in male tegmen often widening towards apex (for about 1 mm); radius sector branching distinctly before middle of tegmen. Phallus membranous. Ovipositor elongo-falcate, margins serrulate near apex; gonangulum with ventro-apical angle projecting.

Remarks. – There are two females from northern Thailand at hand that cannot be assigned to any described species and that obviously represent two different species. As the corresponding males are not known, I hesitate to name the new taxa, but an informal description of the two females is given below.

Distribution. – The *poaeifolia*-group was previously known with one species each from Java, Sumatra, Borneo and Malaysia. The material at hand proves that the range of the group extends at least to the mountains of northern Thailand (maps 1, 3).

Elimaea (Elimaea) sp. 1

(figs. 115, 125, 138, map 3)

Material studied. – Thailand: 1 ♀, Chiang Mai prov., Chiang Dao, iv.1958, Phon, DAB (Lot 2409).

Description. – Female: Fastigium verticis narrow, sulcate, apex obtuse and step-like declined to fastigium frontis. Pronotum with disc nearly flat and with a low medial carina which is replaced by a furrow behind transverse sulcus and distinct again before apex; transverse sulcus arcuate; paranota circa 1.5 times longer than high with a longitudinal carina below middle of height, ventral margin slightly convex, anterior and posterior angles rounded, humeral sinus distinct. Tegmen narrow, subparallel-sided, apex rounded; radius sector branching distinctly before middle. Anterior femur with spines on ventro-internal margin. Mesofemur with spines on ventro-external margin; postfemora lacking. Knee lobes of pro- and mesofemur bispinose. Anterior tibia with dorsal and ventral, external and internal apical spurs. Anterior and medial legs very thin.

Male unknown.

Female: Tenth abdominal tergite with apical mar-

gin subsinuate. Epiproct long-triangular with apex obtuse; basal half bulging and with a medial furrow, apical half flattened. Cerci long-conical, moderately curved, apex subacute. Subgenital plate transverse, with a medio-longitudinal fold (artefact?); apical margin transversely truncate but slightly excised in middle; apico-lateral angles with two faint, obtuse, bulging swellings (fig. 115). Gonangulum of ovipositor with a strong projection pointing (ventro-)apicad (figs. 125, 138).

Coloration: Uniformly yellowish brown (discoloured?). Pronotum with dark dots on disc and lateral angles. Tegmen with light veins and veinlets and dark cells, less expressed in anterior-apical area.

Measurements of female (length in mm): Body 23; pronotum 4.5; tegmen 36.0; tegmen width 4.5; mesofemur 13.5; ovipositor 8.3.

Remarks. — This species is close to the following, it differs by the transverse subgenital plate, the stouter process of the gonangulum which is pointing apicad not ventrad and the lateral lobes of pronotum with the ventral margin broadly rounded not truncate.

Elimaea (Elimaea) sp. 2

(figs. 114, 126, 137, 139, map 3)

Material studied. — Thailand: 1 ♀, Tak prov., Mae Salid, Monkrating, 700m, 1.viii.1992, at night, ci.

Description. — Fastigium verticis narrow, sulcate, apex obtuse and step-like declined to fastigium frontis. Pronotum with disc nearly flat and with a medial carina which becomes subobsolete in metazona, lateral angles rounded; transverse sulcus broad-Y-shaped; anterior margin concave, posterior margin rounded; paranota circa 1.5 times longer than high with a longitudinal carina in about middle of height, ventral margin substraight, anterior and posterior angles rounded, humeral sinus present. Tegmen surpassing hind knees, narrow, parallel-sided, apex rounded; radius sector branching distinctly before middle of tegmen. Anterior femur with spines on ventro-internal margin, meso- and postfemur with spines on ventro-external margin. Knees of all femora bispinose. Anterior tibia with dorsal and ventral, external and internal, apical spurs.

Male unknown.

Female: Tenth abdominal tergite with apical margin subsinuate. Epiproct subparallel-sided in circa basal half, with a medial furrow and lateral bulges, flat and long-triangular in apical half. Cerci long-conical, moderately curved, apex subobtuse (fig. 139). Subgenital plate with disc circa pentagonal in general outline and with a medial furrow in apical half; lateral area sloping and prolonged into spinose projections pointing apicad (fig. 114). Gonangulum of ovipositor with a short, conical, obtuse projection pointing ventrad (figs. 126, 137).

Coloration: Green; pronotum and tergites with black dots. Tegmen with black dots forming three indistinct bands in radial and medial areas; costal area with red spots.

Measurements of female (length in mm): Body 22; pronotum 4.0; tegmen 34.0; tegmen width 4.0; postfemur 24.5; ovipositor 8.0.

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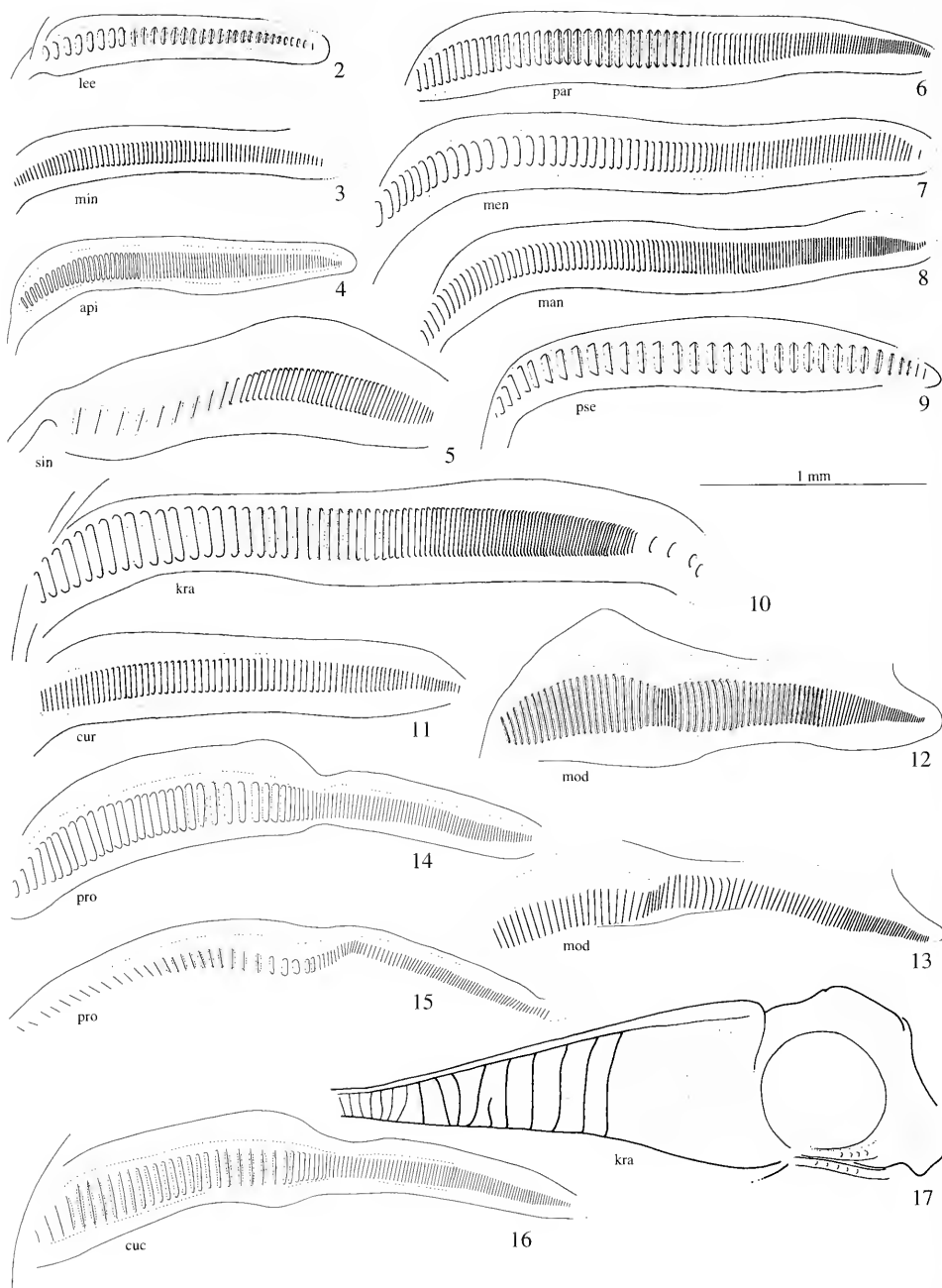
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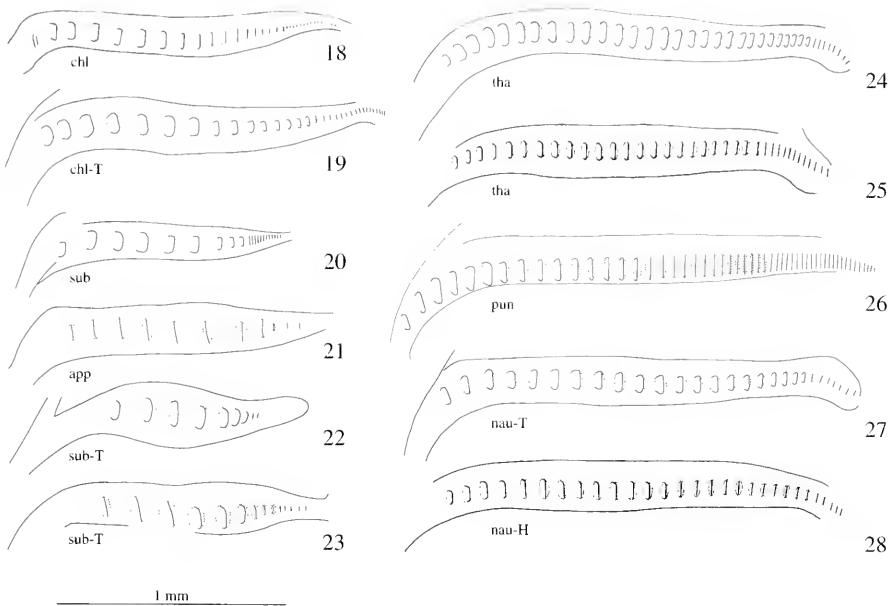
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Abbreviations for species names in figs. 2-150:

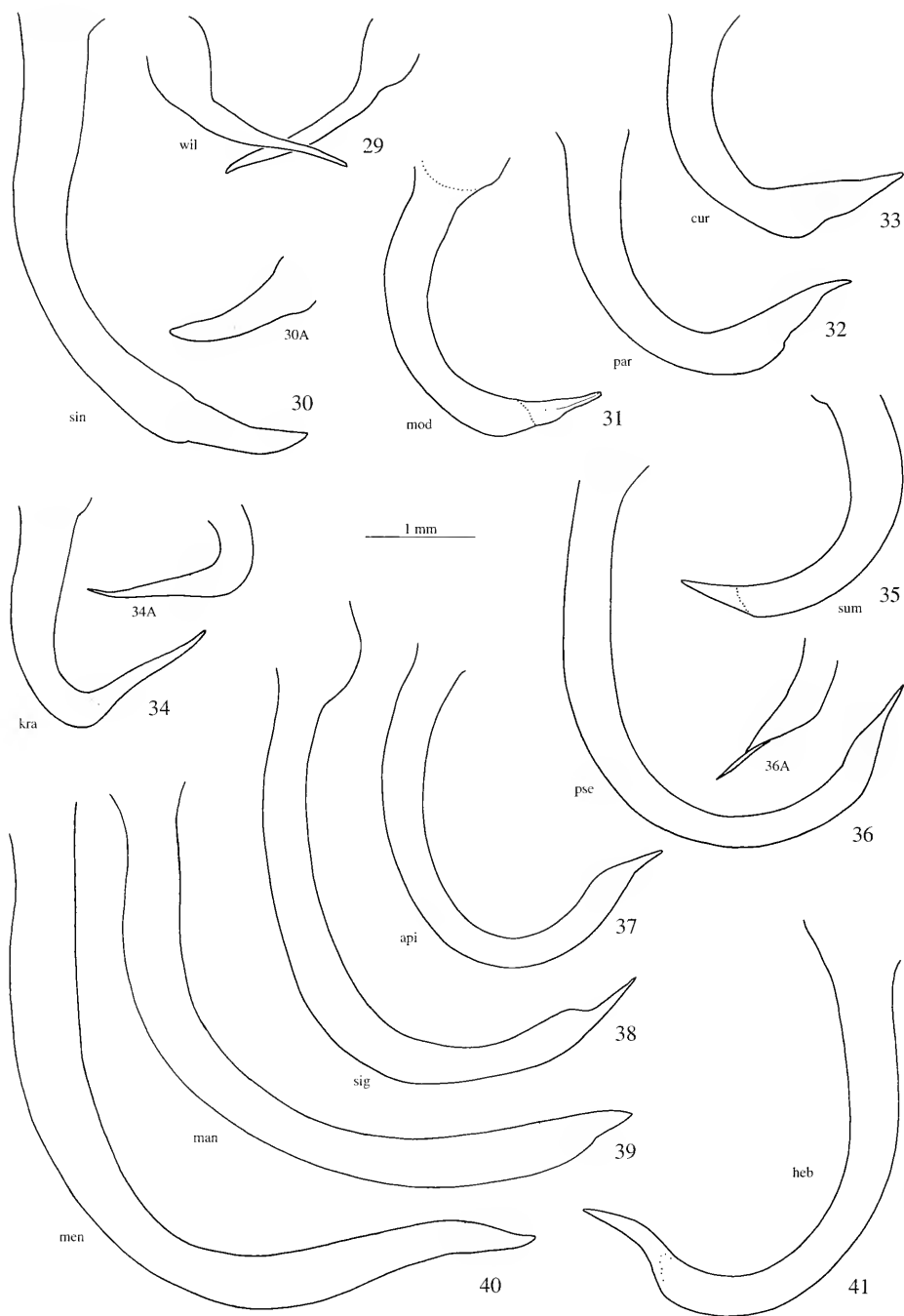
api	<i>E. (R.) apicata</i> sp. n.	pen	<i>E. (R.) pentaspina</i> sp. n.
app	<i>E. (E.) appendiculata</i> Brunner, 1878	pro	<i>E. (H.) procera</i> Ingrisch, 1990
chl	<i>E. (E.) chloris</i> (De Haan, 1842)	pse	<i>E. (R.) pseudochloris</i> sp. n.
cuc	<i>E. (H.) cucullata</i> Ingrisch, 1990	pun	<i>E. (E.) punctifera</i> (Walker, 1869)
cur	<i>E. (R.) curvicercata</i> (Brunner, 1891)	roa	<i>E. (R.) roseolata</i> (Brunner, 1891)
heb	<i>E. (R.) hebaridi</i> Karny, 1926	sia	<i>E. (R.) siamensis</i> Karny, 1926
kra	<i>E. (R.) kraussi</i> Karny, 1926	sig	<i>E. (R.) signata</i> (Brunner, 1878)
lee	<i>E. (O.) leeuwenii</i> Karny, 1926	sin	<i>E. (R.) sinuata</i> sp. n.
man	<i>E. (R.) maninjauensis</i> sp. n.	sp1	<i>E. (E.)</i> sp. 1
men	<i>E. (R.) mentawaiii</i> sp. n.	sp2	<i>E. (E.)</i> sp. 2
min	<i>E. (O.) minor</i> (Brunner, 1891)	sub	<i>E. (E.) subcarinata</i> (Stål, 1861)
mod	<i>E. (R.) modiglianii</i> sp. n.	sum	<i>E. (R.) sumatrana</i> Karny, 1926
nau	<i>E. (E.) nautica</i> sp. n.	tha	<i>E. (E.) thalii</i> sp. n.
nec	<i>E. (R.) neglecta</i> Karny, 1926	tra	<i>E. (R.) transversa</i> Ingrisch, 1990
par	<i>E. (R.) parumpunctata</i> (Serville, 1839)	wil	<i>E. (R.) willemsei</i> Karny, 1926
		H	specimen from Hawaii
		T	specimen from Thailand.



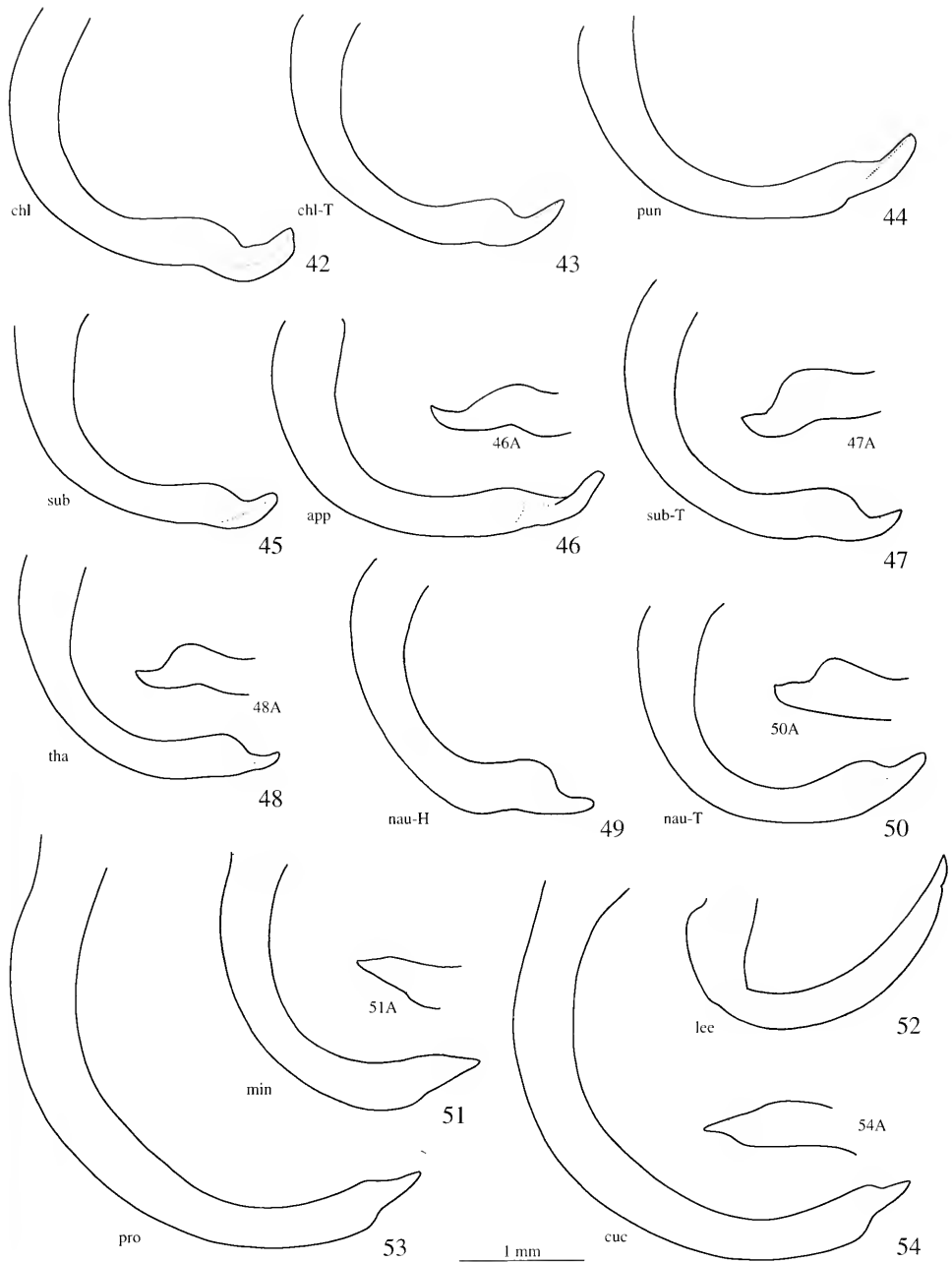
Figs. 2-17. – 2-16, Stridulatory files of *Elimaea* species: 2, *E. (O.) leeuwenii*; 3, *E. (O.) minor*; 4, *E. (R.) apicata*; 5, *E. (R.) sinuata*; 6, *E. (R.) parumpunctata*; 7, *E. (R.) mentaweei*; 8, *E. (R.) maninjauensis*; 9, *E. (R.) pseudochloris*; 10, *E. (R.) kraussi*; 11, *E. (R.) curvicercata*; 12-13, *E. (R.) modiglianii* (13 oblique profile); 14-15, *E. (H.) procera* (15 oblique profile); 16, *E. (H.) cucullata*; 17, dorsal field of right tegmen of *E. (R.) kraussi*.



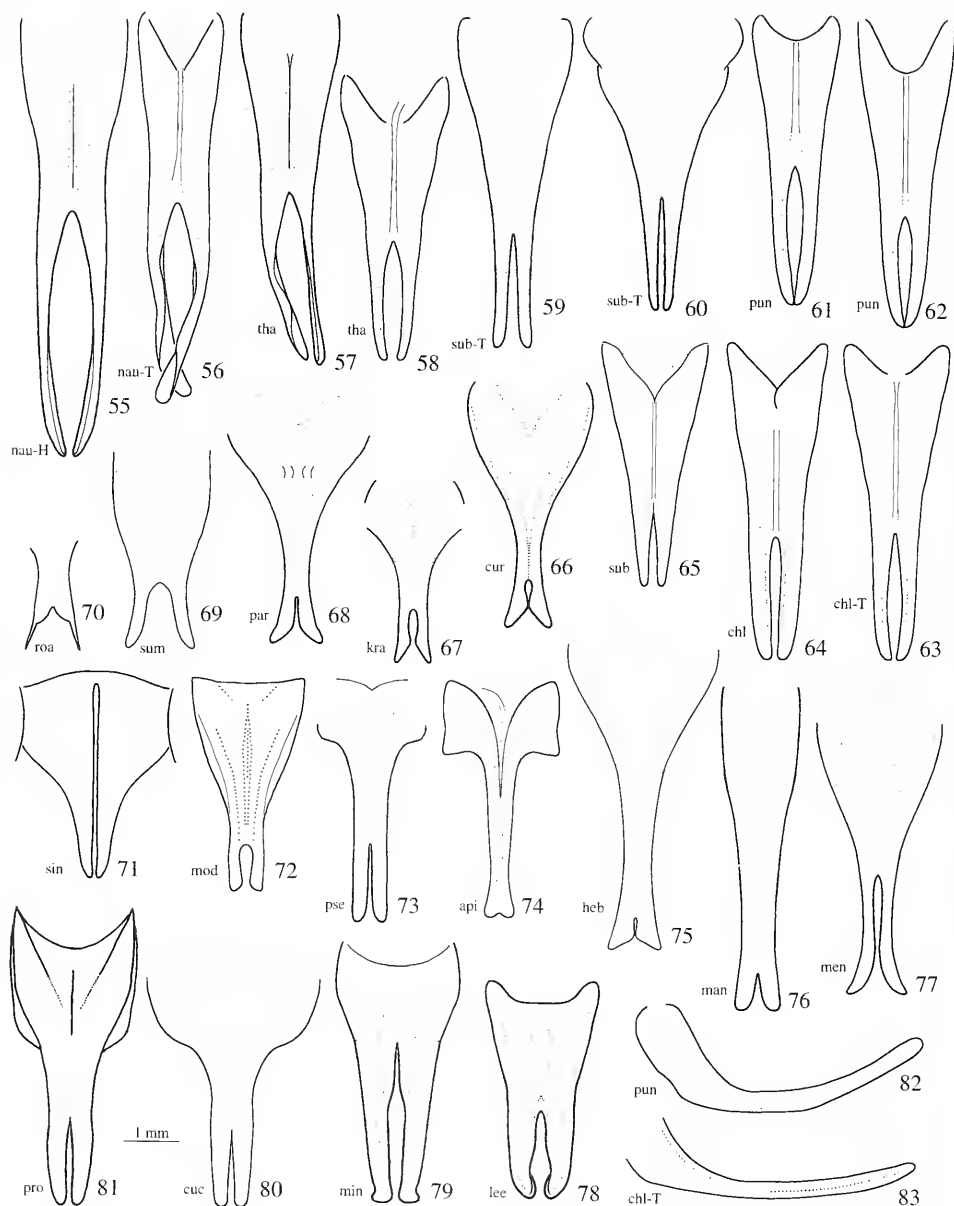
Figs. 18-28. Stridulatory files of *Elimaea* species. — 18-19, *E. (E.) chloris* (18, Java, syntype; 19, Bangkok, Thailand); 20-23, *E. (E.) subcarinata* (20, Hongkong, syntype; 21, Indochina, type of *E. (E.) appendiculata*; 22-23, Doi Khun Tan, Thailand); 24-25, *E. (E.) thailii* (24, Monkrating, Thailand; 25, Doi Musoc, Thailand); 26, *E. (E.) punctifera*, Silhet, Bangladesh, type; 27-28, *E. (E.) nautica* (27, Khao Soi Dao, Thailand; 28, Caumana Cave, Big Island, Hawaii).



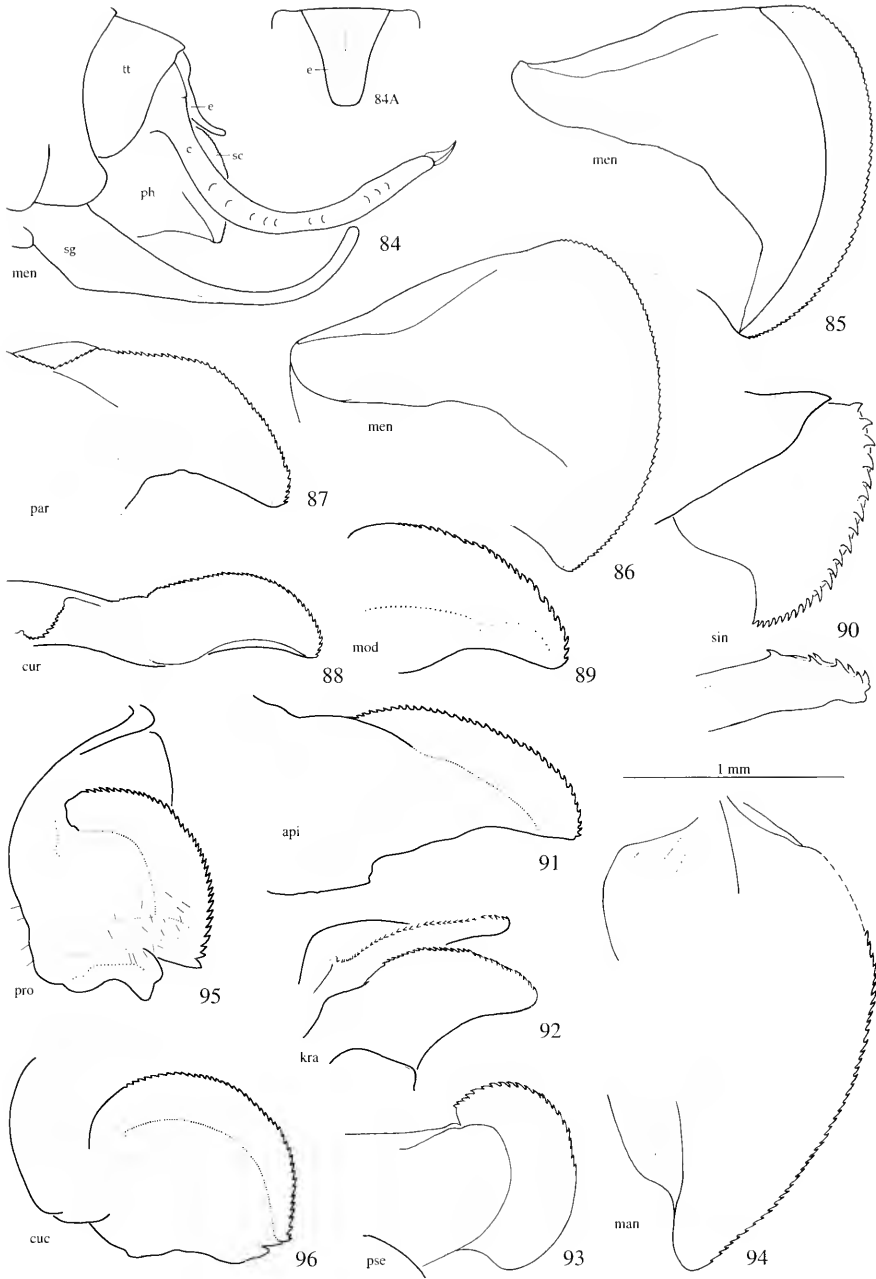
Figs. 29-41. Male cerci of *Elimaea* species (dorsal view; A = apex in ventral view). – 29, *E. (R.) willemsei*; 30, *E. (R.) sinuata*; 31, *E. (R.) modiglianii*; 32, *E. (R.) parumpunctata*; 33, *E. (R.) curvicercata*; 34, *E. (R.) kraussi*; 35, *E. (R.) sumatrana*; 36, *E. (R.) pseudochloris*; 37, *E. (R.) apicata*; 38, *E. (R.) signata*; 39, *E. (R.) maninjauensis*; 40, *E. (R.) mentawai*; 41, *E. (R.) hebardii*. [35, 41 after Hebard 1922; 38 after Karny 1926a; 29 after Karny 1926b; all modified].



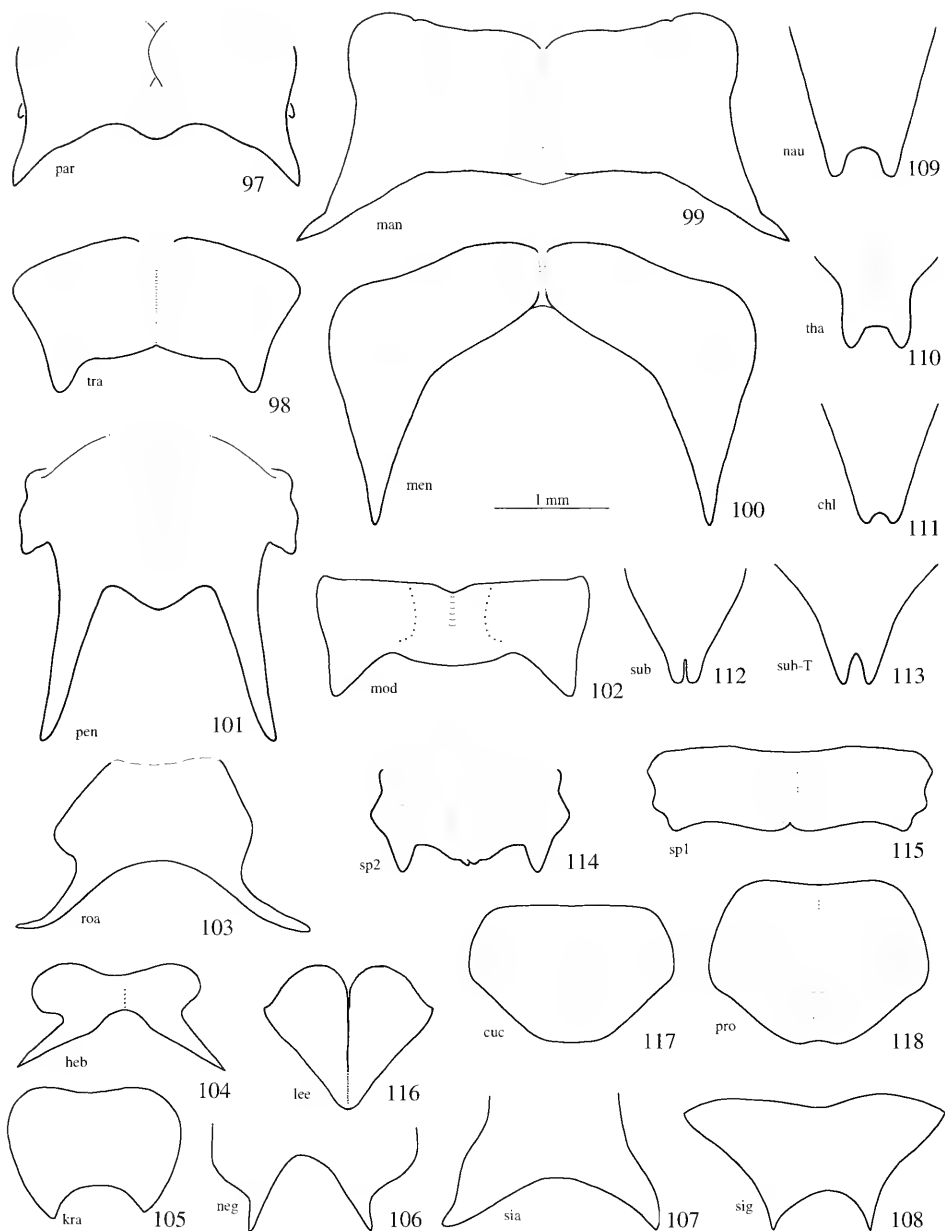
Figs. 42-54. Male cerci of *Elimaea* species (dorsal view, A = apex in ventral view). — 42-43, *E. (E.) chloris* (42, Java; 43, Bangkok, Thailand); 44, *E. (E.) punctifera*, Silhet, Bangladesh, type; 45-47, *E. (E.) subcarinata* (45, Hongkong, syntype; 46, Indochina, type of *E. (E.) appendiculata*; 47, Doi Khun Tan, Thailand); 48, *E. (E.) thaii*, Doi Musoe, Thailand; 49-50, *E. (E.) nautica* (49, Caumana Cave, Big Island, Hawaii; 50, Khao Soi Dao, Thailand); 51, *E. (O.) minor*, Tretes, Java; 52, *E. (O.) leeuwenii*, Thong Pha Phum, Thailand; 53, *E. (H.) procera*, Khao Soi Dao, Thailand; 54, *E. (H.) cucullata*, Erawan, Thailand.



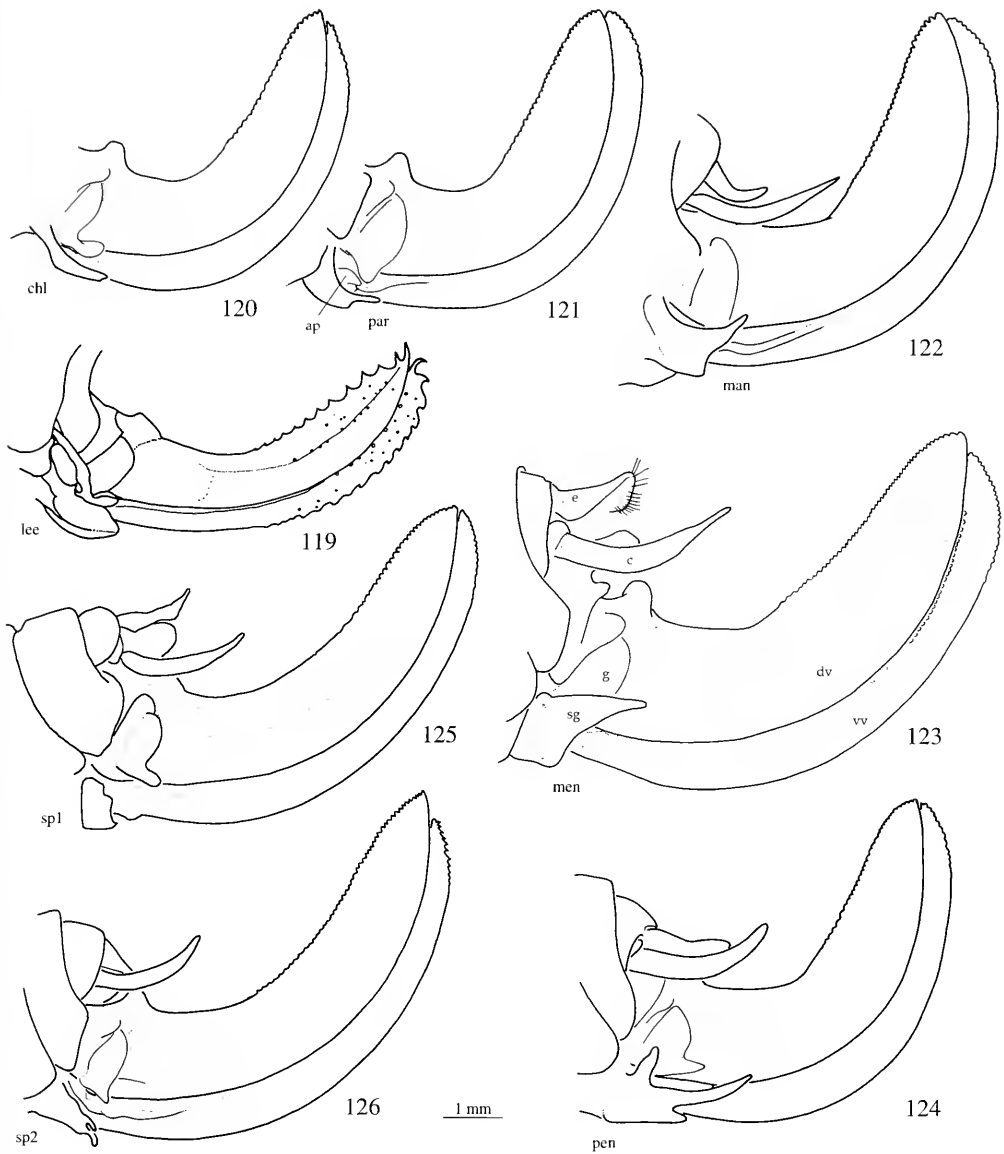
Figs. 55-83. Male subgenital plate of *Elimaea* species in ventral view (82-83 in lateral view). – 55-56, *E. (E.) nautica* (55, Caumana Cave, Big Island, Hawaii; 56, Khao Soi Dao, Thailand); 57-58, *E. (E.) thaili* (57, Doi Musoe; 58, Monkkrating, Thailand); 59-60, *E. (E.) subcarinata*, Doi Khun Tan, Thailand (59, air-dried; 60, freeze-dried); 61-62, *E. (E.) punctifera*, type (61, ventro-apical view; 62 ventral view); 63-64, *E. (E.) chloris* (63, Bangkok, Thailand; 64, Palabuan Ratu, Java); 65, *E. (E.) subcarinata*, Hongkong, syntype; 66, *E. (R.) curvicerata*; 67, *E. (R.) kraussi*; 68, *E. (R.) parumpunctata*; 69, *E. (R.) sumatrana*; 70, *E. (R.) roseolalata*; 71, *E. (R.) sinuata*; 72, *E. (R.) modiglianii*; 73, *E. (R.) pseudochloris*; 74, *E. (R.) apicata*; 75, *E. (R.) hebardei*; 76, *E. (R.) maninjauensis*; 77, *E. (R.) mentawaiii*; 78, *E. (O.) leeuwenii*; 79, *E. (O.) minor*; 80, *E. (H.) cucullata*; 81, *E. (H.) procerata*; 82, *E. (E.) punctifera*, type; 83, *E. (E.) chloris*, Java. [69, 75 after Hebard 1922; 70 after Karny 1926c; 78, 81 after Ingrisch 1990a; all modified].



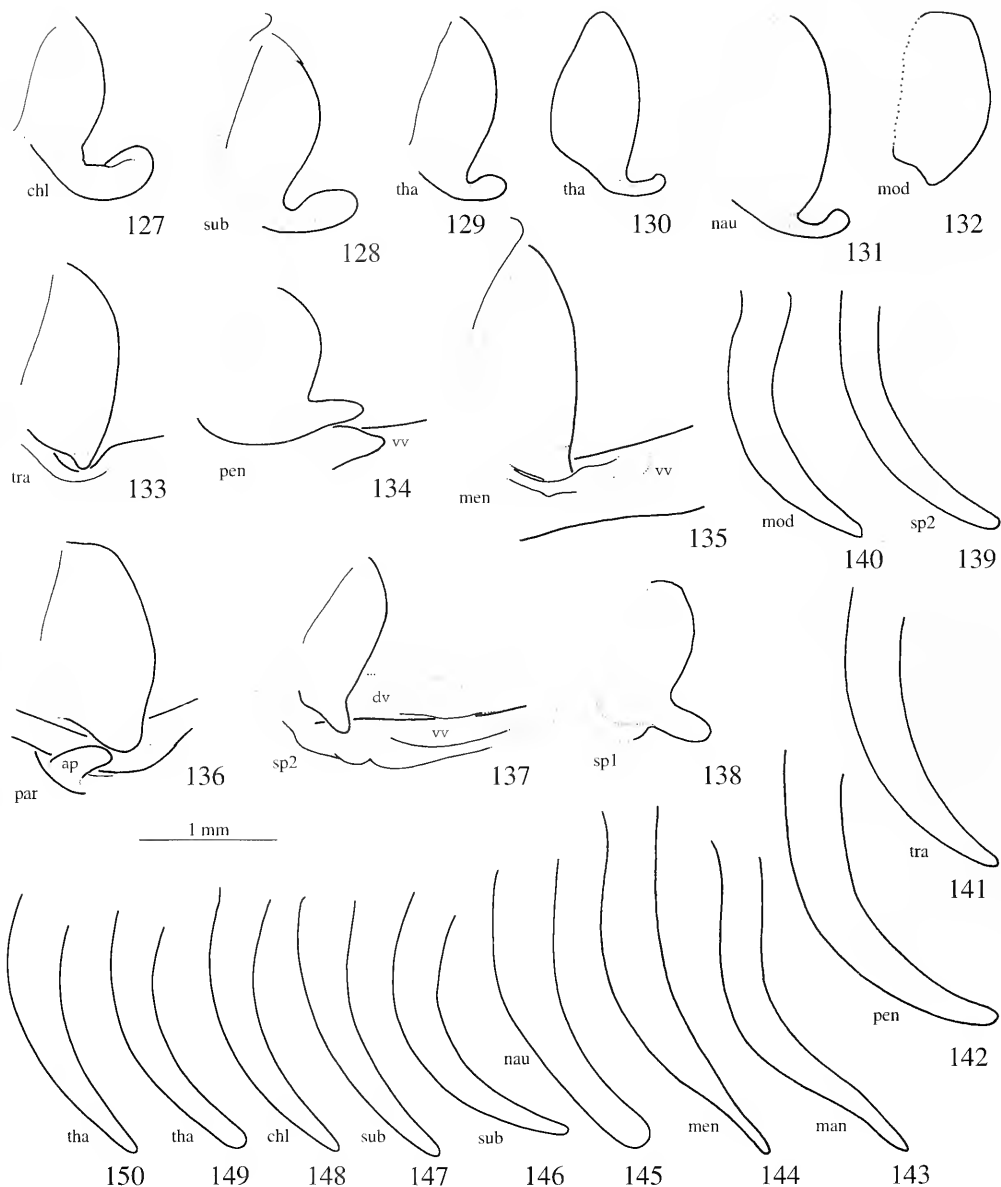
Figs. 84-96. – 84-86, *Elimaea (R.) mentawai*: 84, abdominal apex; 84a, epiproct; 85, phallus sclerite in medial view; 86, same in lateral view. – 87-96, phallus sclerites of *Elimaea* species in lateral view: 87, *E. (R.) parumpunctata*; 88, *E. (R.) curvicerata*; 89, *E. (R.) modighianii*; 90, *E. (R.) sinuata* (paired dorsal and unpaired ventral sclerites); 91, *E. (R.) apicata*; 92, *E. (R.) krausi*; 93, *E. (R.) pseudochloris*; 94, *E. (R.) maninjauensis*; 95, *E. (H.) procerata*; 96, *E. (H.) cucullata*. – Abbreviations: *tt* tenth abdominal tergite, *e* epiproct, *c* cercus, *ph* phallus, *sc* phallus sclerite, *sg* subgenital plate.



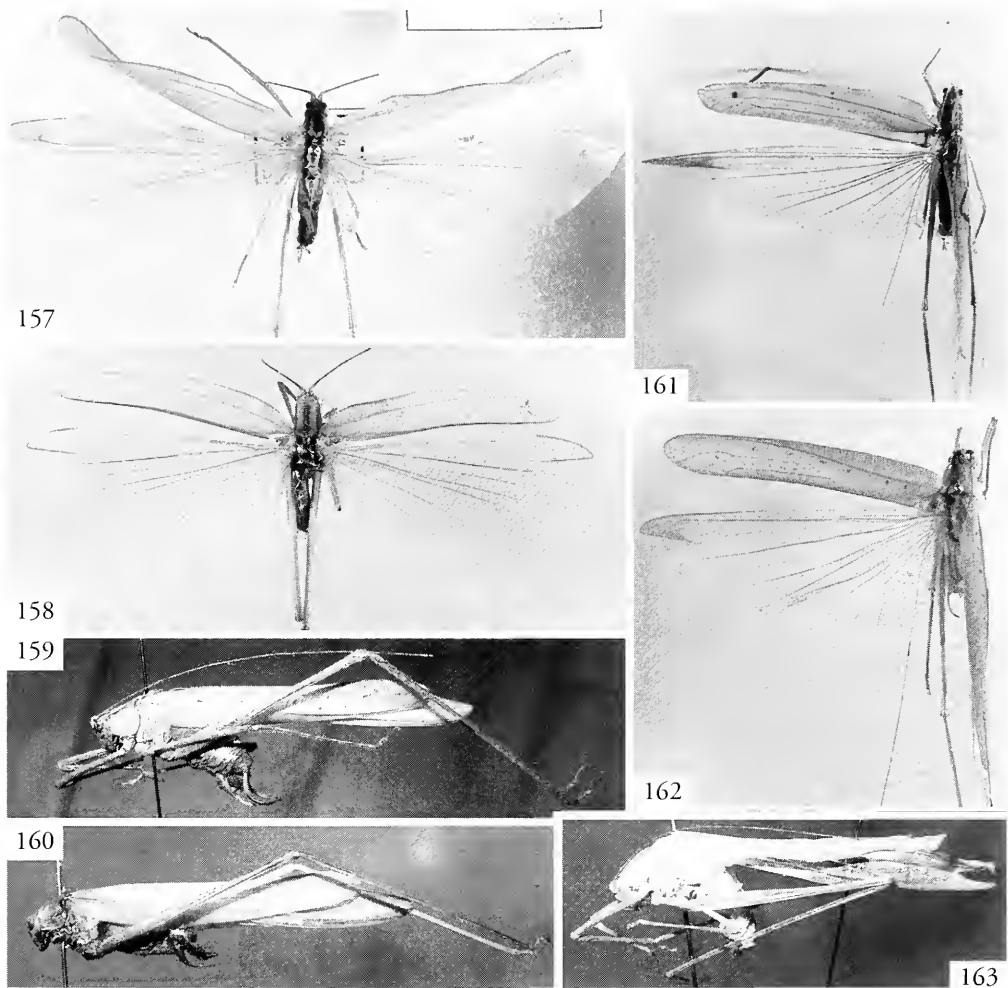
Figs. 97-118. Female subgenital plate of *Elimaea* species. — 97, *E. (R.) parumpunctata*; 98, *E. (R.) transversa*; 99, *E. (R.) maninjauensis*; 100, *E. (R.) mentawai*; 101, *E. (R.) pentaspina*; 102, *E. (R.) modiglianii*; 103, *E. (R.) roseolata*; 104, *E. (R.) hebaridi*; 105, *E. (R.) kraussi*; 106, *E. (R.) neglecta*; 107, *E. (R.) siamensis*; 108, *E. (R.) signata*; 109, *E. (E.) nautica*, Caumana Cave, Big Island, Hawaii; 110, *E. (E.) thaili*, Doi Chiang Dao, Thailand; 111, *E. (E.) chloris*, Bogor, Java; 112-113, *E. (E.) subcarinata* (112, Hongkong, syntype; 113, Doi Khun Tan, Thailand, freeze-dried); 114, *E. (E.)* sp. 2; 115, *E. (E.)* sp. 1; 116, *E. (O.) leeuwenii*; 117, *E. (H.) cucullata*; 118, *E. (H.) procera*; [103, 105 after Karny 1926a; 104 after Karny 1926b; 106-108 after Karny 1926c; all modified].



Figs. 119-126. Ovipositor of *Elimaea* species. – 119, *E. (O.) leeuwenii*; 120, *E. (E.) chloris*, Bogor, Java; 121, *E. (R.) parumpunctata*; 122, *E. (R.) maninjauensis*; 123, *E. (R.) mentawai*; 124, *E. (R.) pentaspina*; 125, *E. (E.) sp. 1*; 126, *E. (E.) sp. 2* – Abbreviations: ap appendage, c cercus, dv dorsal valve, e epiproct, g gonangulum, sg subgenital plate, vv ventral valve.

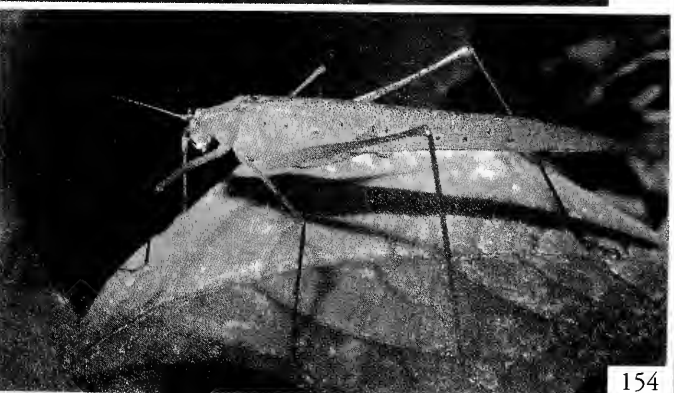


Figs. 127-150. – 127-138, gonangulum at base of ovipositor of *Elimaea* species: 127, *E. (E.) chloris*, Bogor, Java; 128, *E. (E.) subcarinata*, Doi Khun Tan, Thailand; 129-130, *E. (E.) thaii*, (129, Doi Chiang Dao; 130, Monkrating, Thailand); 131, *E. (E.) nautica*, Caumana Cave, Big Island, Hawaii; 132, *E. (R.) modiglianii*; 133, *E. (R.) transversa*; 134, *E. (R.) pentaspina*; 135, *E. (R.) mentawai*; 136, *E. (R.) parumpunctata*; 137, *E. (E.)* sp. 2; 138, *E. (E.)* sp. 1 – 139-150, left female cercus of *Elimaea* and *Rhaebelima* species: 139, *E. (E.)* sp. 2; 140, *E. (R.) modiglianii*; 141, *E. (R.) transversa*; 142, *E. (R.) pentaspina*; 143, *E. (R.) maninjauensis*; 144, *E. (R.) mentawai*; 145, *E. (E.) nautica*, Caumana Cave, Big Island, Hawaii; 146-147, *E. (E.) subcarinata* (146, Doi Khun Tan, Thailand; 147, Hongkong, syntype); 148, *E. (E.) chloris*, Bogor, Java; 149-150, *E. (E.) thaii* (149, Doi Chiang Dao; 150, Monkrating, Thailand). – Abbreviations: ap appendage of ventral ovipositor valve, dv dorsal ovipositor valve, vv ventral valve.



[Figs. 151-156 see page 102]

Figs. 157-163. Habitus of *Elimaea* and *Rhaebelima* species. – 157, *E. (E.) chloris*, syntype male (RMNH); 158, *E. (E.) subcarinata*, syntype male (NRS); 159, *E. (R.) mentawai*, holotype male (MZB); 160, *E. (E.) punctifera*, holotype male (BMNH); 161, *E. (R.) pseudochloris*, holotype male (DAB); 162, *E. (R.) sinuata*, holotype male (MZB); 163, *E. (E.) appendiculata*, holotype male (NHMW).



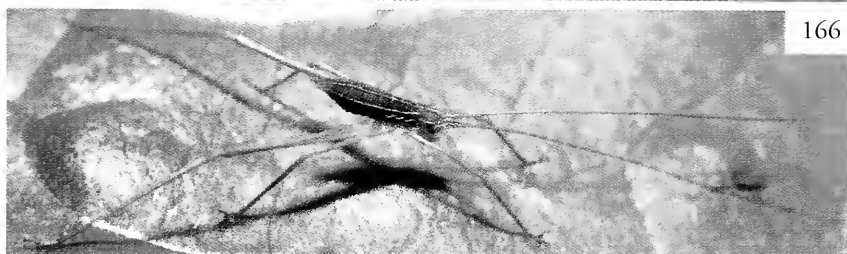
Figs. 151-156. Habitus of *Elimaea* species. – 151, *E. (O.) minor*, male, Tretes, Java; 152, *E. (R.) parumpunctata*, female, Gunung Salak, Java; 153, *E. (R.) maninjauensis*, holotype male, Lake Maninjau, West Sumatra; 154, *E. (R.) apicata*, holotype male, Khao Sok, Thailand; 155, *E. (R.) curvicerata*, Tretes, Java; 156, *E. (E.) thaii*, paratype male, Samoeng, Thailand. [Figs. 157-163: see page 101]



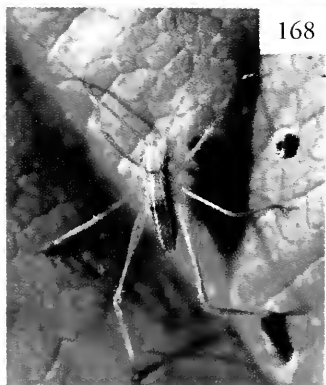
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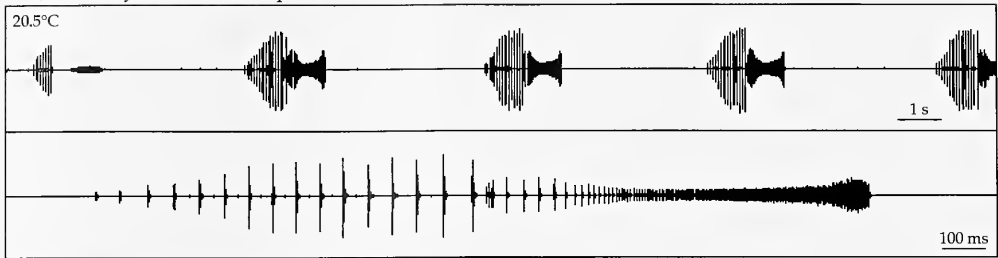
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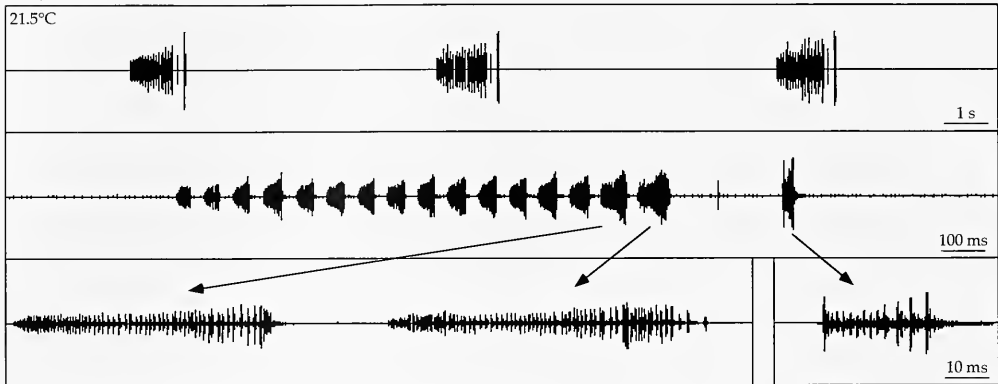
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Figs. 164-168. – 164, *Elimaea* (*E.*) *subcarinata*, female with spermatophore. – 165-168, first instar larvae of: 165, *E. (E.) subcarinata*; 166, *E. (E.) thalii*; 167, *E. (R.) parumpunctata*; 168, *Ectadia fulva*.

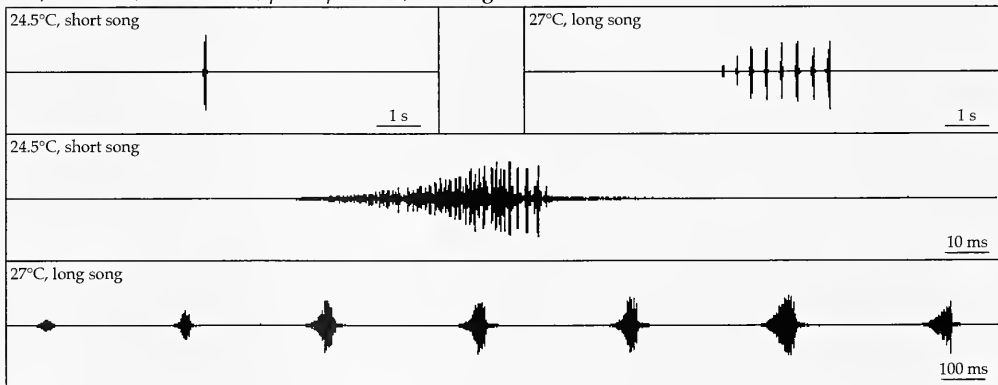
169) *Ectadia fulva*; Doi Suthep



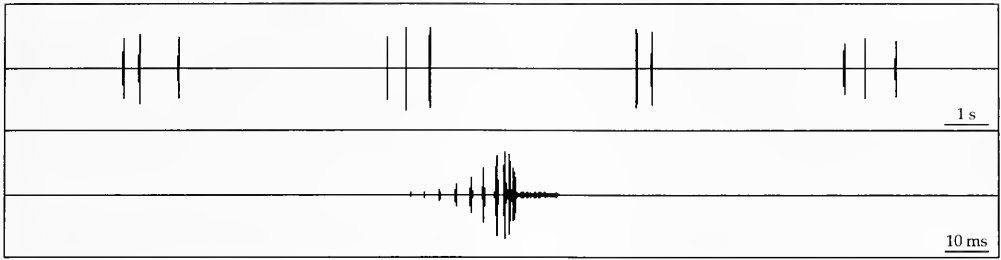
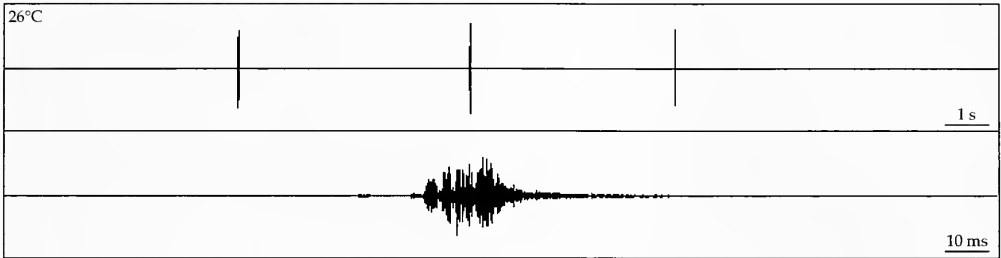
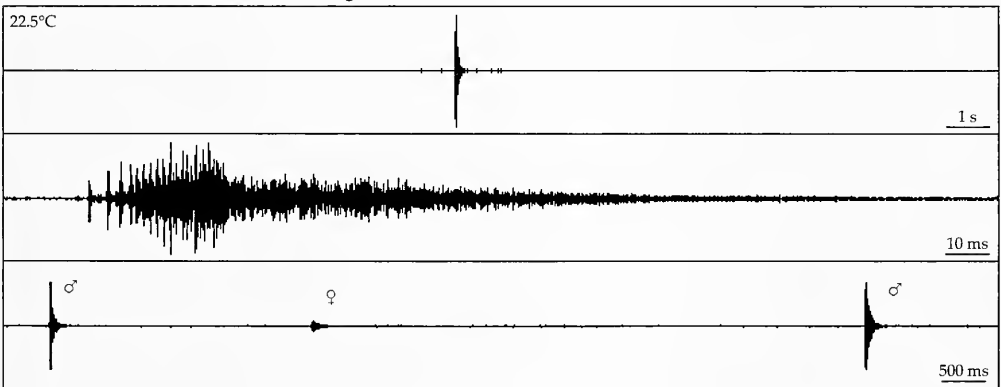
170) *Elimaea (Hemielimaea) cucullata*; Erawan



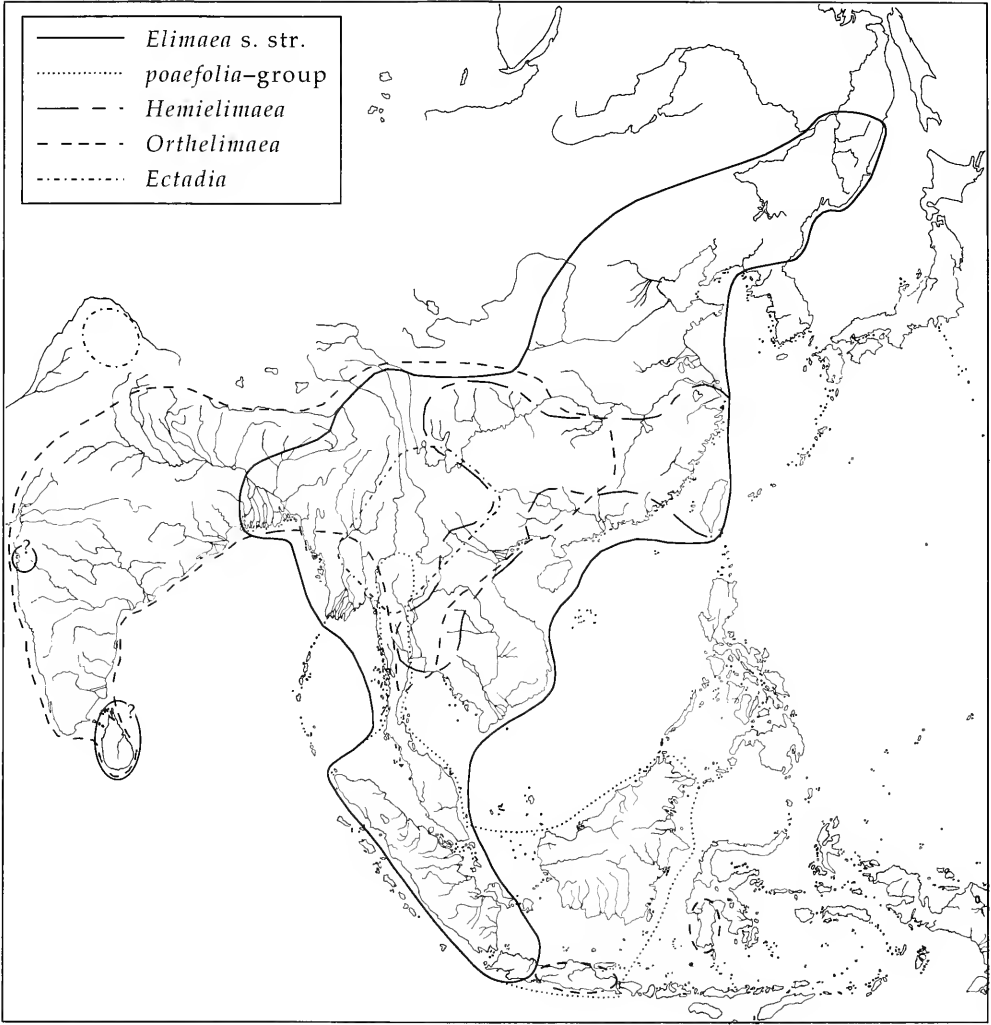
171) *Elimaea (Rhaebelimaea) parumpunctata*; Gunung Salak



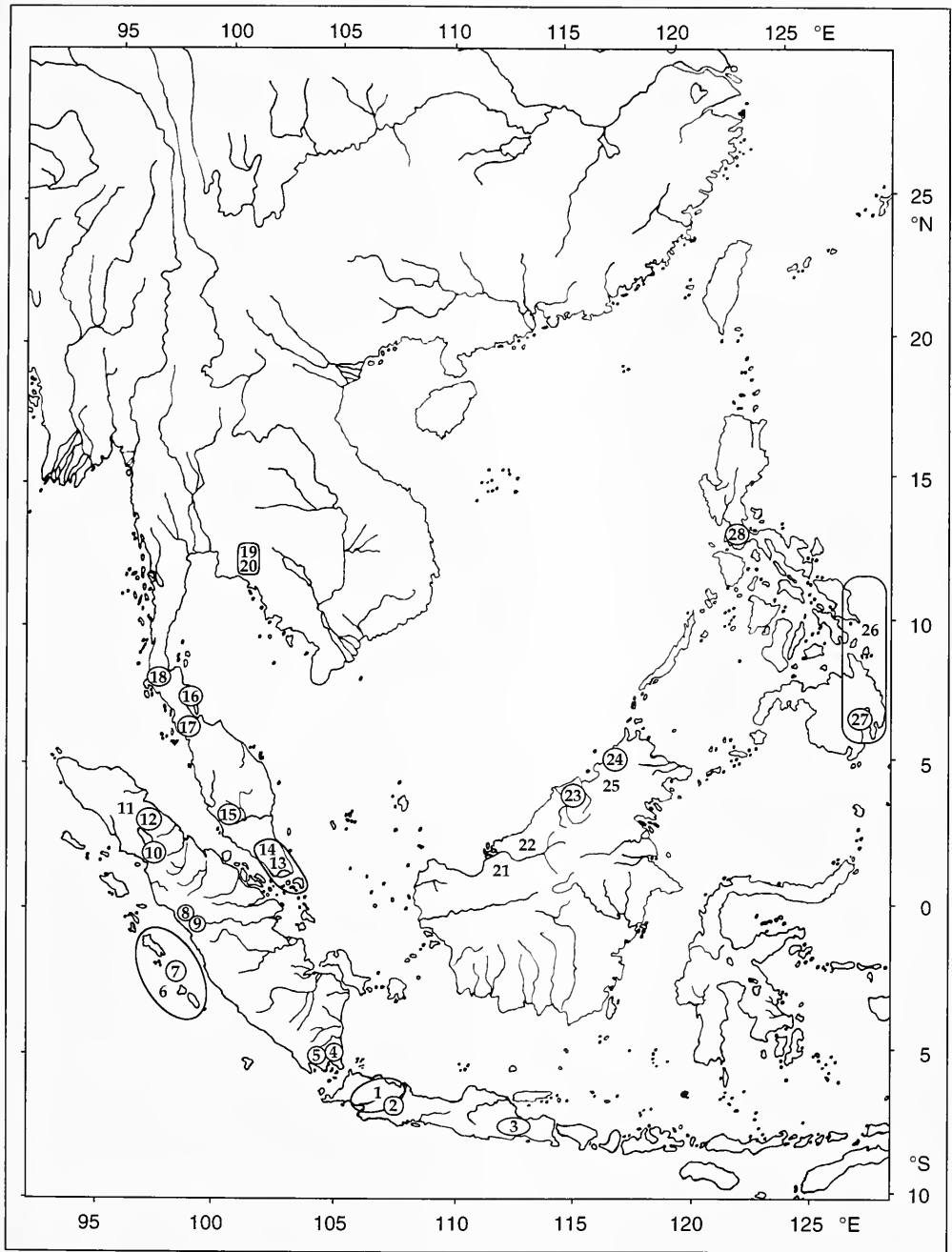
Figs. 169-171. Oscillograms of stridulation. – 169, *Ectadia fulva*: upper row, sequence of echemes; lower row, echeme on expanded time scale; 170, *Elimaea (H.) cucullata*: upper row: series of three echemes; middle row: echeme on expanded time scale; lower row, last three syllables of an echeme; 171, *Elimaea (R.) parumpunctata*: upper row left, one-syllabic song; upper row right, multi-syllabic song; middle row, syllable of short song on expanded time scale; lower row, multi-syllabic song on expanded time scale.

172) *Elimaea (Elimaea) chloris*; Bangkok, Lard Phrao173) *Elimaea (Elimaea) subcarinata*; Doi Khun Tan174) *Elimaea (Elimaea) thaiti*; Samoeng

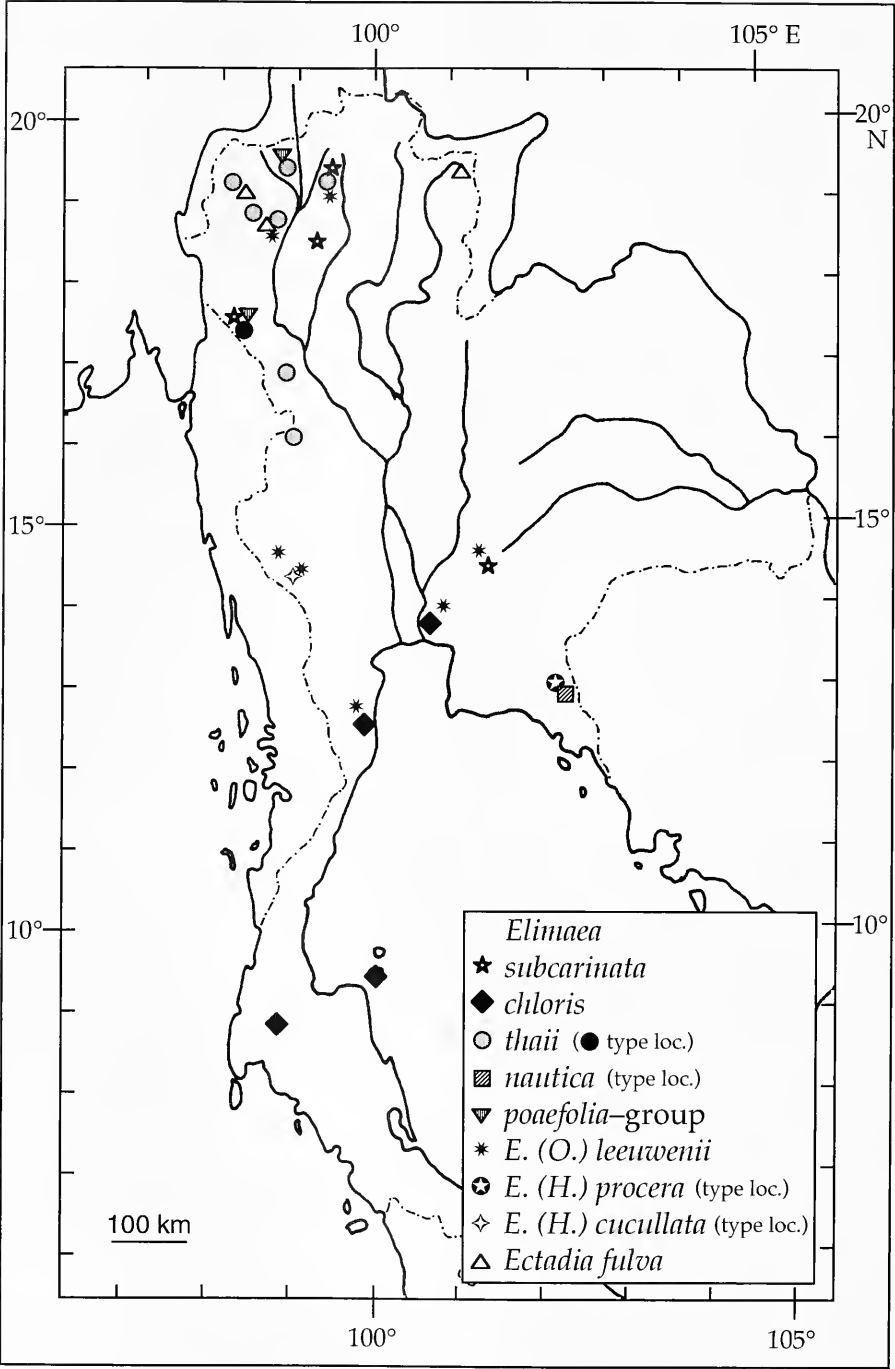
Figs. 172-174. Oscillograms of stridulation. – 172, *Elimaea (E.) chloris*: upper row, series of echemes; lower row, syllable on expanded time scale; 173, *Elimaea (E.) subcarinata*: upper row, series of three syllables; lower row, syllable on expanded time scale; 174, *Elimaea (E.) thaiti*: upper row, one-syllabic song; middle row, syllable on expanded time scale; lower row, male-female response song.



Map 1. Known areas of the genera and subgenera of Elimacini, without subgenus *Rhaebelimaea*.



Map 2. Distribution of *Elimaea* (*Rhaebelima*) species in South East Asia. Species without precise locality data are tentatively placed but not encircled. 1 *parumpunctata*, 2 *kraussi*, 3 *curvicerata*, 4 *hebardi*, 5 *willemsi*, 6 *mentawei*, 7 *sinuata*, 8 *maninjauensis*, 9 *sumatrana*, 10 *modiglianii*, 11 *roseolata*, 12 *adpersa*, 13 *signata*, 14 *spinigera*, 15 *neglecta*, 16 *siamensis*, 17 *pseudochloris*, 18 *apicata*, 19 *transversa*, 20 *pentaspina*, 21 *malayica*, 22 *caricifolia*, 23 *moultonii*, 24 *lamellipes*, 25 *longicercata*, 26 *puncticosta*, 27 *bakeri*, 28 *filicauda*.



Map 3. Distribution of the species of *Elimaea* and *Ectadia* in Thailand; without subgenus *Rhaebelimaea*.

BRYOTROPHA MUNDELLA (DOUGLAS): A NEW
SYNONYM OF *BRYOTROPHA UMBROSELLA* (ZELLER)
(LEPIDOPTERA, GELECHIIDAE)

Rutten, T. & O. Karsholt, 1998. *Bryotropha mundella* (Douglas): a new synonym of *Bryotropha umbrosella* (Zeller) (Lepidoptera Gelechiidae). – Tijdschrift voor Entomologie 141: 109–114, figs. 1–13. [ISSN 0040-7496]. Published 30 November 1998.

The status of *Bryotropha mundella* (Douglas) is discussed. Its genitalia are found to be identical to those of *B. umbrosella* (Zeller). As to the forewings of these two taxa, numerous intermediates exist spanning the whole range between the whitish nominate form of *B. mundella* and the blackish nominate form of *B. umbrosella*. Geographically, *B. mundella* co-distributes with *B. umbrosella*. The two moths are found in the same period of the year and are active during the same time of the day. We therefore conclude that *B. mundella* is a light form of *B. umbrosella*. Lectotypes of *Gelechia umbrosella* Zeller, 1839, and of its synonyms *G. mundella* Douglas, 1850 (syn. n.), *G. portlandicella* Richardson, 1890 and *G. anacampsoidea* Hering, 1924 are designated. [*B. umbrosella* is recorded from Spain for the first time].

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Key words. – Lepidoptera; Gelechiidae; new synonym.

The holarctic genus *Bryotropha* Heinemann, 1870 consists of almost 80 nominal species, about 40 of which are currently recognised as valid. The genus has never been revised, and especially in the south-western part of the palaearctic region there are a number of undescribed species. Even among specialists, *Bryotropha* is regarded as one of the more difficult genera of Microlepidoptera.

Pierce and Daltry (1938) divided the genus into two subgenera, *Bryotropha* s. str. and *Mniophaga* Pierce & Daltry, 1938. In the subgenus *Bryotropha* the male genitalia have a strong, specialised gnathos while the female genitalia have a plate-like signum with two transverse ridges (Sattler 1971). The subgenus *Mniophaga* was reserved for species in which the male has a rather small gnathos and the female a plate-like signum with strong spikes at the corners. There are, however, intermediate taxa, and Sattler (loc. cit.) concluded that a subdivision of *Bryotropha* is unjustified. Differences in the genitalia are distinct between members of the first group ('subgenus' *Bryotropha*), but less distinct between species of the second group ('subgenus' *Mniophaga*) (Rutten, in press). The latter include the small, 'dark' *Bryotropha* species of northern and central Europe, which often cause much confusion. The light

coloured *B. mundella* (Douglas) also belongs to this group and this moth is the subject of the present paper.

According to the original description by Douglas (1850), the distinct feature of *B. mundella* is its light greyish ground colour which distinguish this moth from other members of the genus. Over the years, however, the name *B. mundella* has been given to a whole range of small *Bryotropha* with ground colour varying from nearly white to dark grey. Doubts were raised whether all these forms are representatives of *B. mundella* (see e.g. Pierce & Daltry 1938).

Unfortunately, individual variations within *Bryotropha* species are poorly investigated and the genitalia of *B. mundella* have never been properly described. The drawings published by Pierce and Metcalfe (1935) are not suited for an identification. In the best study on *Bryotropha* so far, Svensson (1962) describes the genitalia of *B. mundella* as resembling those of *B. umbrosella* (Zeller). The description and drawings of *B. mundella* given in Piskunov (1990: 970, 977) probably refer to *B. affinis* or *B. similis* (Stainton). Specimens identified by Piskunov as *B. mundella* and examined by us belonged to *B. similis*.

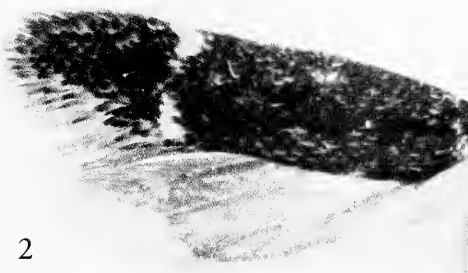
B. mundella is a rather scarce moth, especially on mainland Europe. Only a handful were known from



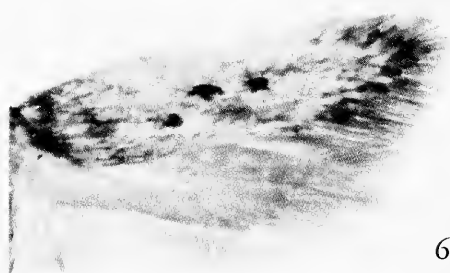
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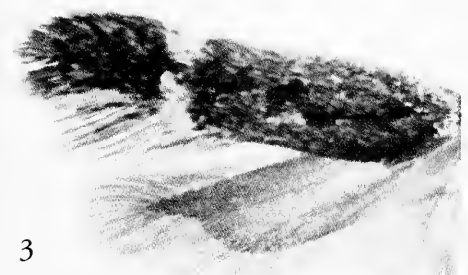
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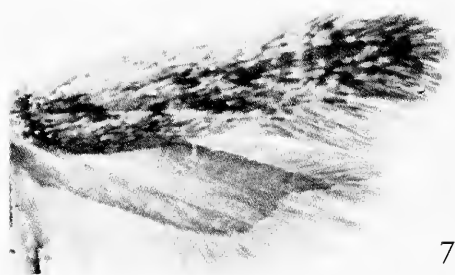
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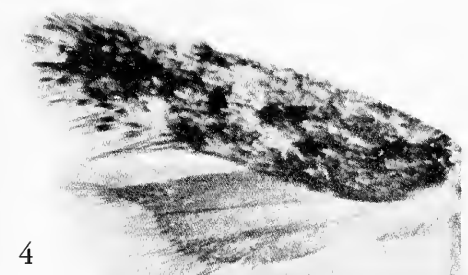
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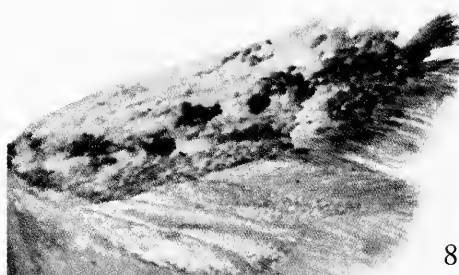
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8

Figs. 1-8. Adults of *Bryotropha*. – 1, nominate form of *B. umbrosella*; The Netherlands, Zwanenwater; 2, forewing of *B. umbrosella* (enlargement of fig. 1); 3, forewing of *B. umbrosella* with a distinctive lighter ground colour; The Netherlands, Terschelling; 4, forewing of *B. umbrosella* revealing strong irroration with whitish scales; The Netherlands, Ameland; 5, extreme whitish form of *B. mundella* with distinct stigmata and dark scales limited to the termen; Ireland, Fanore, Co. Claire; 6, forewing of *B. mundella* showing traces of darker scales near the base of the wing; The Netherlands, Zwanenwater; 7, forewing of *B. mundella* with predominance of greyish scales; The Netherlands, Terschelling; 8, forewing of a very dark *B. mundella* with clearly defined costal and tornal patches; Ireland, Mannin Bay, Co. Galway.



Figs. 9-12. Adults of *Bryotropha*. –9, lectotype of *B. umbrosella*; 10, lectotype of *B. mundella*; 11, nominate form of *B. affinis*, Great Britain, Norwich, Norfolk, 9.IV.1995; 12, light coastal form of *B. affinis*, The Netherlands, Zwanenwater.

The Netherlands until the early 1990's, when a small series were collected from the Frisian islands (Kuchlein 1993). According to the genitalia, however, the moths involved belonged to two other species; specimens with a yellowish to brownish colour belonged to *B. affinis* while those with a whitish or greyish colour, typical for *B. mundella*, invariably had genitalia similar to *B. umbrosella* (Zeller). The implications were obvious, for, if specimens with the external features of *B. mundella* have genitalia which are identical to those of *B. umbrosella*, one may ask whether *B. mundella* is indeed a separate species and not just a light form of *B. umbrosella*.

MATERIAL AND METHODS

Female genitalia were mounted in a ventro-dorsal position. In the case of the male genitalia, lateral mounting was preferred to ventro-dorsal mounting since the latter procedure can distort the shape of the gnathos, which is an essential characteristic in *Bryotropha*. Additional slides of male genitalia were made using the unrolling technique.

Type material is preserved in the collections of the Dorset County Museum (DORC), Dorchester, UK; The Natural History Museum (BMNH), London, UK; National Museum of Natural History (RMNH), Leiden, The Netherlands; Zoologisk Museum, University of Copenhagen (ZMUC), Copenhagen, Denmark, and in the Zoological Museum, University of Helsinki (MZHF), Helsinki, Finland.

RESULTS AND DISCUSSION

Bryotropha umbrosella (Zeller)

Gelechia umbrosella Zeller, 1839: 201. Lectotype ♀: [Poland; Glogów.] 'Gross Glogau, Silesia. 6.vi.1834, Zeller Coll'; 'Walsingham Collection [B.M.] 1910-427'; '*Gelechia umbrosella* Zell. Isis p.201 (1839) Type [male]; abdomen missing'; 'Lectotype [female] *Gelechia umbrosella* Z. teste K. Sattler, 1961' (BMNH). [examined]

Gelechia mundella Douglas, 1850: 64. Lectotype ♂: [Great Britain; New Brighton, Cheshire] '17.52'; 'England, Dgl coll. (Mason 1906)'; 'Walsingham collection [B.M.] 1910-427'; '*Gelechia mundella* Dgl. Tr. Ent. Soc. Lond. (2)I, p. 64 (1850) Type [male]'; 'Genitalia no. 139'. (BMNH) [examined] syn. n.

Gelechia portlandicella Richardson, 1890: 29. Lectotype ♀: [Great Britain; Portland, Dorset.] 'Lectotype *Gelechia portlandicella* Richardson'; 'Portland, Dorset, Richardson Collection 1889'; 'teste T. Rutten 1998' (DORC). [examined]

Bryotropha umbrosella [race] *fulvipalpella* Joannis, 1908: 793. *Gelechia anacampoidella* Hering, 1924: 80. Lectotype ♂: [Finland] 'Tvärminne'; '15.6.1921'; 'Kanerva'; 'Type; *Gelechia anacampoidella*; det. Mart. Hering m[ale]'; 'Mus. Zool. Höfors; Spec. typ. No.7013; *Gelechia anacampoidella* Her'; [genitalia in glycerine vial]; 'Lectotype *Gelechia anacampoidella* Hering des. O. Karsholt 1998' (MZHF) [examined].

Bryotropha oppositella (Thunberg, 1794) sensu Benander 1961: 245 [misidentification].

Bryotropha fuliginosella Snellen, 1882 sensu Lempke 1976: 25 [misidentification].

Diagnosis

Adult. – Wingspan 9–12 mm. Head with very dark greyish brown vertex and yellow to ochreous frons. Thorax as forewing. Forewing very dark greyish brown with blackish discal and plical stigmata barely visible; plical stigma often with a few conspicuous white scales beyond; costal and tornal patches white and usually very prominent, rarely fused to form a fascia.

Variation. – In the form *mundella* the forewing is irrorate with whitish or greyish scales. This makes the blackish stigmata more prominent but obscures the whitish tornal and costal patches. In extreme cases the tornal and costal patches are no longer visible.

Male genitalia. – Gnathos slender, in a strong ($\geq 120^\circ$) but gradual curve, terminating in acute apex. Tegumen alongside gnathos covered with 5–30 small spines. Aedeagus long and slender, with bulbous base and 'whip-like' apex.

Female genitalia. – Posterior margin of segment 8 with a median extension along dorsum, ventral part of segment 8 densely covered with strong wedge-shaped microtrichia. Lamella postvaginalis broad and without lobes; signum square to rectangular with strong spines at the corners.

Remark. – The genitalia of *B. umbrosella* and related species are figured by Rutten (in press).

Biology

The larva feeds until May in a spun tube among mosses (Schütze 1931: 13). Imago univoltine from late May to early August.

B. umbrosella frequents dry sandy places both inland and in coastal areas. *B. mundella* is always found on locations also inhabited by *B. umbrosella*. The two moths appear over the same period of the year. Fieldwork by the second author in Jutland, Denmark, found *B. mundella* flying amongst true *B. umbrosella*. Both were active just before sunset. In contrast, *B. similis*, which also occurred on that locality, was on the wing between sunset and dark.

Distribution

B. umbrosella is widespread in northern and central Europe; less common in southern Europe; absent from Italy and Greece while records for Portugal need confirmation (Karsholt & Riedl 1996: 109). A male specimen identified during our study becomes the first record for Spain: Torre la Higuera, Huelva, 22.iv–09.v.1983, leg. J. Wolschrijn, genitalia slide R0464 (collection of senior author).

The form *mundella* is almost exclusively found along the sandy coasts of the North Sea (the junior author collected specimens up to 50 km inland in Jutland, Denmark); S. Norway, Sweden (only one record from the west coast), Denmark, Northwest Germany, Holland, U.K., Ireland and France (Karsholt & Riedl loc.

cit.). Claims of *mundella* from other countries are based upon misidentifications (see e.g. Karsholt 1995, Karsholt & Huemer 1995). Records from Lithuania (Ivinskis & Piskunov 1976) refer to *B. similis*, those from Japan (Ueda et al. 1995) refer to *B. svenssoni* (Park), or a closely related species.

Remarks

The respective lectotypes of *B. umbrosella* and *B. mundella* are shown in figs. 9 and 10. Even though their colours have bleached with time, the contrast between the two moths is still remarkable and explains why they were considered separate species. One has to realise, however, that the external features of *Bryotropha* species can vary a great deal. The nominate form of *B. umbrosella* with its dark, almost black, forewing and contrasting white markings (figs. 1, 2), is typical for inland locations. In coastal areas specimens often have a lighter colour owing to a more or less heavy irroration with whitish scales (figs. 3, 4). Variations also occur in *B. mundella*. Pure white specimens (fig. 5) are rather rare. Most moths show a weak (fig. 6) to heavy (fig. 7) irroration with darker, greyish, scales, often disclosing the presence of costal and tornal patches (see the lectotype in fig. 10). In cases of a strong irroration with dark scales, the specimens become greyish with prominent costal and tornal patches (fig. 8). Compared with the *B. umbrosella* in figs. 2 to 4, the dark *B. mundella* shown in fig. 8 can now be recognised for what it is: a very light form of *B. umbrosella*.

The smooth transition of a nearly black *B. umbrosella* into a nearly white *B. mundella* (figs. 1–8) thus invalidates the last character separating *B. mundella* from *B. umbrosella*. We thus have to conclude that *B. mundella* is a coastal or ecological form of *B. umbrosella*.

The claim that moths of these two taxa differed in wingshape was disproved by Richardson (1890). The darker colour of the fringe in some *B. mundella* specimens cause the wing itself to stand out strikingly and appear shorter than it is. Taking the fringe into account, *B. mundella* has the same wingspan and wingshape as *B. umbrosella*.

Notes on synonymy

Gelechia umbrosella was described from one male and three females collected in Poland, Zielona Góra, Glogów ('Glogau').

Gelechia mundella Douglas was described from an unspecified number of specimens found in June on sand hills in Great Britain, New Brighton, Cheshire. The lectotype present in the BMNH was dissected a long time ago ('Genitalia no. 139'), and the genital slide can no longer be traced. However, a preparation of a female from the same type-series (slide BMNH no. 25.320) confirmed that the genitalia are identical to



Fig. 13. Lectotype of *G. portlandicella*; Great Britain; Portland, Dorset, Richardson coll. 1889 (DORC).

those of *B. umbrosella*.

Gelechia portlandicella was described from five specimens collected in Gr. Britain, Portland, Dorset in June 1888. Meyrick (1895) synonymised *G. portlandicella* with *B. mundella*. However, doubts on the status of *G. portlandicella* remained (see e.g. Pierce & Daltry 1938). We identified the original type series preserved in the DORC as light forms of *B. umbrosella*. Three specimens had been labeled 'co-types' and had been dissected by N.H. Bennet in the British Museum in 1937. The genitalia of the two males and one female confirmed that the moths belong to *B. umbrosella*. We have selected the female for the lectotype (fig. 13).

Bryotropha umbrosella fulvipalpella Joannis was described from a long series of specimens ['en grand nombre'] from France, Bretagne, Plouharnel. In these moths, segment 2 of the labial palpus is orange. The ZMUC possesses two specimens of *B. umbrosella* labelled 'Vannes, Bretagne'. They originate from Staudinger & Bang-Haas and are probably part of Joannis' type series (although we can not prove this). Segment 2 of the labial palpus of these moths indeed have an orange haze. Though this feature is not found in specimens from central or northern Europe, we consider this to be within the variation of *B. umbrosella*. The status of *fulvipalpella* as a form of *B. umbrosella* remains.

Gelechia anacampoidella was described from an unspecified number of specimens of both sexes from Finland, Tvärminne. It was synonymed with *B. umbrosella* by Hering (1926). Sattler (1960: 29) was of the opinion that *B. anacampoidella* should be regarded as a subspecies of *B. umbrosella*. However, specimens from Finland fall within the range of variation of (dark) *umbrosella* specimens from Central and northern Europe.

Benander (1961: 245) considered *Tinea oppositella* Thunberg, 1794 a senior synonym of *B. umbrosella*. However, *oppositella* of Thunberg is currently consid-

ered a misidentification of *Alucita oppositella* Fabricius, 1775, a junior synonym of *Borkhausenia minutella* (Linnaeus, 1758) (Oecophoridae).

Lempke (1976: 25) and Kuchlein (1993: 272) listed *B. fuliginosella* Snellen (1882) as a synonym of *B. umbrosella*. A study of the type material of *B. fuliginosella* preserved in RMNH proved it to belong to *B. similis* (Karsholt & Kristensen 1995: 474).

Profound coastal or ecological variations are not unique to *B. umbrosella* but are also found in *B. affinis*. The latter species is dark coloured with yellowish markings (fig. 11). In specimens from coastal areas the forewing often is heavily irrorate with yellowish scales. This sometimes gives rise to extreme light forms (fig. 12) with very distinct discal and plical spots and near to indistinct costal and tornal patches. Their yellowish to brownish colour separates light forms of *B. affinis* from light forms of *B. umbrosella* which are greyish or whitish.

As pointed out by Karsholt & Skou (1987: 88), the record of specimens of *B. mundella* in copula with *B. affinis* (Larsen 1927: 97) is erroneous. All specimens in question (at least as far as they are preserved in the ZMUC) belong to the nominate form of *B. umbrosella*.

Conclusions

During our study on *B. mundella* we noticed that the genitalia of this moth are identical to those of *B. umbrosella* and that the geographical distribution of *B. mundella* is completely covered by that of *B. umbrosella*. *B. mundella* is mainly found in coastal areas, flying amongst nominate forms of *B. umbrosella*. Also in their external features, we found all sorts of intermediate forms linking an almost black *B. umbrosella* to an almost white *B. mundella*. The evidence thus indicates that *B. mundella* is a light, coastal or ecological form of *B. umbrosella*.

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ANNOTATED CATALOGUE OF THE DILARIDAE (INSECTA: NEUROPTERA) OF THE WORLD

Oswald, J. D., 1998. Annotated Catalogue of the Dilaridae (Insecta: Neuroptera) of the World. – *Tijdschrift voor Entomologie* 141: 115–128. [ISSN 0040-7496]. Published 30 November 1998. The neuropteran family Dilaridae is catalogued. Data on the status, primary type, type locality and original place of publication are given for 67 valid species and 14 synonymous species-group names. Status, type species, etymology and gender information are given for four valid genera and seven synonymous genus-group names. *Nepal* is reported as a previously unrecognized synonym of *Dilar*. *Dilar grandis* and *Dilar marmoratus* are new combinations from *Rexavius*. *Berothella bannana* is removed from the Dilaridae and transferred to the family Berothidae as *Berotha bannana*, comb. n.

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The neuropteran family Dilaridae, ‘pleasing lacewings’, is a small family presently composed of 67 valid recent species, with a combined distribution encompassing parts of North and South America, Europe, Asia and Africa. Dilarids form a distinct clade within the order Neuroptera, and are characterized by males with pectinate antennae, females with elongate ovipositors (a feature that they share with raphidiopterans and some mantispids), and distinctive details of the terminalia in both sexes. Dilarids are relatively rare both in the field and in collections and are of no known economic importance. Immatures are associated with soil or dead wood. No fossil dilarids are currently known. The purpose of the present work is to provide a concise bibliographic, nomenclatural and taxonomic foundation for the family that can serve the twin aims of providing an entry point into the scattered dilarid literature and a stimulus for further systematics study of the group.

History

The rarity of dilarids in the field is underscored by the fact that the first known species, *Dilar nevadensis*, does not appear in the scientific literature until 1838 (Rambur 1838, illustrated), and was not formally described until four years later (Rambur 1842) – a comparatively late date for a genus of insects that possesses several species with an aggregate distribution stretching broadly across southern Europe. *Dilar nevadensis* was treated at its inception as a new species

and genus, and it and its relatives have long been recognized as a distinctive group within the Neuroptera. The genus *Dilar* was originally placed by Rambur in his ‘Tribu Semblides’, together with several genera now placed in the orders Megaloptera and Raphidioptera. Soon thereafter, Newman (1853), in his reclassification of the Neuroptera *sensu lato*, provisionally placed the ‘Dilaridae’ as a division of his group Stegoptera, subgroup Corydalina, along with taxa now attributed to the Ithonidae and Megaloptera. Newman’s classification was not widely adopted and his name Dilaridae appears not to have come into general use. By the late 1800’s *Dilar* was recognized as a neuropteran (planipennian) genus, and was typically included within a broad concept of the family Hemerobiidae. During the first two decades of the twentieth century, the taxonomic concept of the Hemerobiidae was radically altered. Many genera and groups of genera were formally aggregated or reaggregated into family-group taxa during this period, and several of these were widely accorded full family rank. Among these groups was the Dilaridae, which was treated as a tribe (Dilarini, e.g., Navás 1914), subfamily (Dilarinae, e.g., Banks 1913) and full family (Dilaridae, e.g., Handlirsch [1906]) during this time. Current usage accords dilarids family rank, with two subfamilies, the Dilarinae and Nallachiinae.

Navás ([1909a], 1914), in the earliest revisionary studies of the group, synthesized the prior descriptive work of nineteenth century authors and his own early twentieth century work on the fauna of Spain and

neighbouring regions. In his 1914 review of the family for the Genera Insectorum, Navás recognized seven genera and 26 species. Of these, 21 species, but only 2 genera, are presently considered valid. During the Navásian era heavy emphasis was placed on venational traits as diagnostic characters for the identification and justification of new neuropteran taxa at all ranks. During this period, however, the full extent of venational variation was frequently not well known for taxa established at both the specific and generic levels. Subsequent reevaluation of generic limits, based principally on male terminalic traits, has led to a reduction in the number of accepted dilarid genera, and it is now widely recognized that considerable venational plasticity exists in many dilarid species. Characters of the male terminalia have now come to replace venational traits as the characters of choice for delimiting dilarid taxa, especially species. Although male terminalic characters were figured as early as 1909 (Navás [1909a]), the added effort and difficulties of studying, describing and figuring this complex character system hindered its use and the full recognition of its value during the early twentieth century. As in other neuropterid groups, however, dilarid studies profited from the growing realization throughout the 1930's that the male terminalia provided a significant new source of novel, stable and reliable species-level characters. Subsequent reviews and revisions of dilarid taxa (e.g., Carpenter 1940, 1947, Nakahara 1955b) made extensive use of male terminalic traits, and modern descriptions and revisions (e.g., Adams 1970, Aspöck et al. 1980, Monserrat 1988b) rely heavily on male terminalic characters to delimit species.

Future Research

The most pressing current need in dilarid systematics is for a comprehensive revision of Old World dilarine species. The last complete revisions covering the Old World are the seriously outdated works of Navás ([1909a], 1914). Since that time, the number of nomenclaturally valid Old World dilarid species has approximately tripled. The European dilarid fauna has recently been the subject of several good revisionary treatments (Aspöck et al. 1980, Monserrat 1988b), but the lack of a synthetic work for the Oriental region and the adjacent parts of central and eastern Asia renders positive identification of material from these areas extremely difficult. The size of such a project (ca. 50 species) would be quite appropriate for a Ph.D.-level dissertation. Questions of interest include:

(i) How variable are male terminalic traits among Old World dilarids?,

- (ii) What monophyletic subgroups can be recognized within this fauna?, based on what characters?,
- (iii) What is(are) the phylogenetic relationship(s) between Old and New World dilarids?,
- (iv) How old is the dilarid clade?,
- (v) Why are there no known dilarid fossils?,
- (vi) Why are dilarids absent from Australia?

Any study of the higher phylogeny of the family should include representatives of New World *Nallachius*, Old World *Dilar* and *Berothella* and the actual or possible Old World nallachiine taxa *Nallachius krooni* (southern Africa), *Nallachius ponomarenkoi* (Vietnam) and *Neonallachius annandalei* (India).

Biology

Dilarid biology is poorly known. The larvae of only five species are known, only four of which have been described. The best known of these is the Nearctic-Neotropical species *Nallachius americanus*, whose larvae have been reported from under the bark of both recently- and long-dead broadleaf trees, where they undoubtedly feed on soft-bodied arthropod prey that occur in the same microhabitat (Gurney 1947, MacLeod & Spiegler 1961). Larvae of *Dilar turcicus* and *Dilar septentrionalis* have been collected from soil samples, Ghilarov (1962) and Makarkin (pers. comm., larvae not described), respectively. The larvae of two additional species, *Nallachius krooni* and *Dilar pumilus*, have been reared from eggs laid by captive females, see Minter (1992) and Monserrat (1988b). Until recently, all known adult dilarids were fully macropterous and presumed to be volant. However, Pantaleoni & Letardi (1996) report the capture of a brachypterous *Dilar* female that is probably attributable to *Dilar parthenopaes*.

Keys

A key is provided below to the two subfamilies of the Dilaridae. The subfamily Nallachiinae currently contains only a single valid genus, *Nallachius*. The three nomenclaturally valid dilarine genera listed in the following catalogue are widely considered only doubtfully distinct. For this reason, a key to these taxa has not been attempted. The construction of a reliable key to supraspecific taxa within the Dilarinae cannot proceed until revisionary studies that identify more rigorously diagnosable subgroups within this taxon have been completed. Bibliographic references to published species-level keys in the genera *Dilar* and *Nallachius* are cited below under their respective catalogue entries.

KEY TO THE SUBFAMILIES OF THE DILARIDAE

(after Adams 1970, New 1989)

1. Forewing MA branching from R basal to fork R1-Rs (i.e., as a branch from the 'radial stem'; or, rarely, MA entirely free from R); male antenna with more than 3 apical flagellomeres that lack lateral processes [Europe, northern Africa, Asia].....Dilarinae
- + Forewing MA branching from R distal to fork R1-Rs (i.e., as a branch from RS); male antenna never with more than 3 apical flagellomeres that lack lateral processes [North and South America, southern Africa, Asia]Nallachiinae

CATALOGUE

Format

All known family-, genus- and species-group names that have been applied to taxa presently placed within the family Dilaridae are treated in the catalogue below. Information on taxon diversity and distribution, important systematics literature and biology and immature stages is summarized for all valid family- and genus-group taxa. Genus-group name records provide, additionally, data on type species, etymology and gender, with appropriate bibliographic references. Species citations provide information on original publication, distribution, type locality and primary type kind, sex and depository (to the extent known). Type locality data is presented in a standardized format using current political subdivision names, with verbatim quotes from the literature provided parenthetically where confusion might arise. Latitude and longitude coordinates are provided for all sites that could be rigorously located. Coordinate data are shown in brackets if they were derived from secondary sources (e.g., maps or gazetteers), but are shown unbracketed if they were cited in the original description of a species. Synonymical citations are given under the subheading 'Synonymy'. Under the subheading 'Status', a recent (where possible) authoritative work is cited that uses the name in the nomenclatural form in which it is treated in the catalogue. The third edition of the International Code of Zoological Nomenclature has been applied to questions of nomenclature, and relevant articles and sections of the Code are referenced throughout the catalogue text.

Collection Acronyms

The following collection acronyms are used in the catalogue to indicate type repositories:

- ASPOCK Horst & Ulrike Aspöck, private collection,
Wien [=Vienna], Austria;
BAU Beijing Agricultural University Insect

- Collection, Beijing, China;
BMNH Natural History Museum [formerly the British Museum (Natural History)], London, England, United Kingdom;
INBIO Instituto de Biodiversidad, Santo Domingo de Heredia, Costa Rica;
INPA Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil;
ISNB Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium;
IZASB Institute of Zoology, Academia Sinica, Beijing, China;
MCNM Museo Nacional de Ciencias Naturales, Madrid, Spain;
MCZ Museum of Comparative Zoology, Cambridge, MA, USA;
MNHP Museum National d'Histoire Naturelle, Paris, France;
MONSERAT Victor J. Monserrat, private collection, Madrid, Spain;
MZB Museo Zoologia, Barcelona, Spain
MZUN Museo di Zoologia, Università di Napoli, Napoli [=Naples], Italy;
NCIP National Collection of Insects, Pretoria, South Africa;
NHMB Naturhistorisches Museum Basel, Basel, Switzerland;
NHMW Naturhistorisches Museum, Wien [=Vienna], Austria;
NSMT National Science Museum (Natural History), Tokyo, Japan;
NZSI Zoological Survey of India, National Zoological Collection, Calcutta, West Bengal, India;
PMY Peabody Museum of Natural History, Yale University, New Haven, CT, USA;
REAL P. Réal, private collection, Aix-en-Provence, France;
ZMHA Zoologisches Museum für Hamburg, Hamburg, Germany;
ZMHB Museum für Naturkunde, Humboldt Universität, Berlin, Germany;
ZMUM Zoological Museum, Moscow State University, Moscow, Russia;
ZSM Zoologische Staatssammlung, Munich, Germany.

Family Dilaridae Newman, 1853

Dilaridae Newman, 1853 (as a 'division' of the Corydalina).
Type genus: *Dilar* Rambur, [1838].

Species and distribution. – 67 species; Eastern United States south to Argentina, including the West Indies (17 spp.), Oriental and southern Palearctic regions (49 spp.), southern Africa (1 sp.). No dilarids

are currently known from tropical Africa, Australia, Oceania or extreme northerly or southerly latitudes. No fossils attributable to the Dilaridae are currently known.

Reviews, revisions and keys. – Navás [1909a] (World, revision, keys); Navás 1914 (World, review, keys); see also *Dilar* and *Nallachius* below.

Biology and immature stages. – See *Dilar* and *Nallachius* below. The larva described and figured by Takahashi (1942) as a dilarid is probably the larva of a nevrothid of the genus *Nipponeurorthus*, not a dilarid. Tjeder (1937) compared the adult morphology of dilarids and raphidiopterans.

Subfamily Dilarinae Newman, 1853

Dilarinae – Banks 1913: 211 (as a subfamily of the Hemerobiidae). Type genus: *Dilar* Rambur, [1838].

Dilarini – Navás, 1914: 5 (as a tribe of the Dilaridae). Type genus: *Dilar* Rambur, [1838].

Species and distribution. – 48 species; Oriental and southern Palearctic regions.

Reviews, revisions and keys. – See *Dilar* below.

Biology and immature stages. – See *Dilar* below.

Genus *Berothella* Banks, 1934

Berothella Banks, 1934: 567. Type species: *Berothella phantoma* Banks, 1934: 568, by monotypy. Etymology: Unexplained, probably Beroth- (< *Beroth[a]*, a berothid genus-group name) – -ella (< L. -ellus, a diminutive suffix), in reference to the original supposed berothid affinities of this genus. Gender: Feminine, from the gender appropriate to the suffix -ella, Art. 30b. Status: Oswald & Penny 1991: 12.

Notes: *Berothella* was originally placed in the family Berothidae; it was transferred to the family Dilaridae by MacLeod and Adams ([1968]: 256).

Species and distribution. – 2 species; China and continental Malaysia. A third species described in this genus, *Berothella bannana*, belongs to the Berothidae, see 'Taxa removed from the Dilaridae' below.

Reviews, revisions and keys. – None.

Biology and immature stages. – Unknown.

Berothella phantoma Banks, 1934 [Malaysia]

Berothella phantoma Banks, 1934: 568. Holotype, male, BMNH. Type locality: Malaysia: Selangor: Bukit Kuru (hill) [3°33'N 101°43'E]. Status: MacLeod & Adams ([1968]: 256).

Notes: Type citation by MacLeod & Adams ([1968]: 256). This species was originally described as a berothid. It was confirmed as a dilarid by Kimmins in MacLeod & Adams ([1968]: 256).

Berothella pretiosa Banks, 1939 [China]

Berothella pretiosa Banks, 1939: 469. Holotype, male, MCZ. Type locality: China: Kwangtung: Hainan (island), 'Tahan'. Status: MacLeod & Adams ([1968]: 256).

Notes: This species was originally described as a berothid. It was confirmed as a dilarid by MacLeod & Adams ([1968]: 256).

Genus *Dilar* Rambur, [1838]

Dilar Rambur, [1838]: pl. 9. Type species: *Dilar nevadensis* Rambur, [1838]: pl. 9, by monotypy. Etymology: From Dilar, a river flowing west from the western edge of the Sierra Nevada (mountains) of southern Spain, see Navás ([1909a]: 628). Gender: Masculine, no originally attributed or implied gender, here considered masculine, Art. 30d. Status: Oswald & Penny 1991: 21. Known incorrect subsequent spellings: *Dillar*, *Dialar*, *Didar*.

Cladocera Hagen, 1860: 56, nomen nudum. Included species: *Cladocera marmorata* Hagen, 1860: 56, nomen nudum. Etymology: Unexplained, probably Clado- (< Gr. *klados*, branch or twig) – -cera (< Gr. *keras*, horn), in reference to the branched antennae, a characteristic of male dilarids. Status: Oswald & Penny 1991: 21.

Notes: '*Cladocera marmorata* Hoffm. Mus. Berol.' was cited by Hagen (1860: 56) without description, definition or indication, and is therefore unavailable, Art. 12a. The binomen *Cladocera marmorata* apparently originated as a manuscript name that was recorded by Hagen from the identification label of a specimen in the Hoffmansegg Collection of the Museum für Naturkunde, Humboldt Universität, Berlin. Hagen subsequently (1866b: 399) synonymized *Cladocera* with *Dilar*, and *C. marmorata* with *Dilar nevadensis* Rambur, without either name ever having been made available.

Lidar Navás, 1909b: 153. Type species: *Dilar meridionalis* Hagen, 1866a: 295, by original designation. Etymology: An anagram of *Dilar*, a dilarid genus-group name, see Navás (1909b: 153). Gender: Masculine, inferred from the combination '*Lidar nemorosus*', Art. 30d. Synonymy: H. Aspöck et al. 1980: 187. Status: Oswald & Penny 1991: 21. Known incorrect subsequent spellings: *Lider*.

Fuentenus Navás, 1909b: 154. Type species: *Dilar campestris* Navás, 1903a: 380 (= *Dilar saldubensis* Navás in Laguna, 1902), by original designation. Etymology: From the surname of Reverend D. José María de la Fuente, Spanish priest and entomologist, see Navás (1909b: 155; [1909a]: 657). Gender: Masculine, no originally attributed or implied gender, here considered masculine, Art. 30d. Synonymy: H. Aspöck et al. 1980: 187. Status: Oswald & Penny 1991: 21.

Rexavius Navás, [1909a]: 664. Type species: *Dilar nietneri* Hagen, 1858b: 482, by subsequent designation by Navás 1914: 10. Etymology: An anagram of Xaverius, from the Latinized surname of Saint Francisco Javier, Spanish missionary to India and Japan, see Navás ([1909a]: 664). Gender: Masculine, inferred from the combination '*Rexavius japonicus*', Art. 30d. Synonymy: Kuwayama 1962: 376. Status: Oswald & Penny 1991: 21.

Notes: *Rexavius* was synonymized with *Dilar* without explicit comment by Kuwayama (1962: 376). Kuwayama's synonymy was presumably based on his placement of the species *japonicus* in the genus *Dilar*, rather than in *Rexavius*, where it had been placed by Navás (1909a: 665) as one of the two species originally included in *Rexavius*. The type species of *Rexavius* has also been transferred back to *Dilar* from *Rexavius* by H. Aspöck & U. Aspöck (1968: 3). Two additional species, *grandis* and *marmoratus*, also nominally exist in the genus *Rexavius*. Both are here transferred to *Dilar*. I have examined syntypical ma-

terial of both *grandis* and *marmoratus* from the MCZ, and both species clearly fall within the broad concept of *Dilar* adopted in this catalogue.

Nepal Navás, [1909a]: 661. syn. n. Type species: *Nepal harmandi* Navás, [1909a]: 661, by original designation. Etymology: From Nepal, a region (later country) of the Indian subcontinent that contains, or lies near, the type localities of the two species originally included in this genus, see Navás ([1909a]: 661). Gender: Masculine, no originally attributed or implied gender, here considered masculine, Art. 30d.

Notes: All four species that have at one time or another been placed in this genus have subsequently been removed to *Dilar*, *formosanus* and *kanoi* by Nakahara (1955b) and *bornei* and *harmandi* by H. Aspöck & U. Aspöck (1968). Thus, although it has not previously been listed as such, *Nepal* is currently a junior subjective synonym of *Dilar*.

Species and distribution. – 45 species; Oriental and southern Palearctic regions.

Reviews, revisions and keys. – Navás 1903a (Spain, review); Kuwayama 1921 (Japan, review, key); Nakahara 1955b (Japan & Taiwan, revision); Kuwayama 1962 (Japan, review, key); Aspöck et al. 1980 (Europe, review, key); Minter 1986 (Africa, review); Dorokhova 1987 (European USSR, key); Monserrat 1988a (Navás species, revision); Monserrat 1988b (Iberian Peninsula, revision, keys); Zakharenko 1988 (USSR, review); Makarkin 1995 (Far Eastern Russia, key).

Biology and immature stages. – Ghilarov 1962 (*turcicus*: biology, larva, figs); Popov 1973 (*turcicus*: egg, larva); Gepp 1984 (*turcicus*: larva, fig); Monserrat 1988b (*pumilus*: larva, figs); Gepp 1990 (*turcicus*: egg, fig). The larva of *Dilar septentrionalis* is known (Makarkin, pers. comm.), but undescribed.

Dilar algericus Navás, 1909 [Algeria] Nomen dubium

Dilar algericus Navás, [1909a]: 638. Holotype, male, MNHP. Type locality: Algeria: Alger [36°50'N 3°00'E, =Algiers, =Argel (Spanish)] (as: 'Argel'). Status: Monserrat 1988a: 19. Notes: See Legrand & Lachaise (1994: 87) for a detailed account of the holotype; earlier type citations by Navás (1925: 188) and Monserrat (1988b: 199).

Dilar aspersus C. Yang in Huang et al., 1988 [China]

Dilar aspersus C. Yang in Huang et al., 1988: 197. Holotype, male, BAU. Type locality: China: Tibet: Nyingchi County (as: 'Xizang: Nyingchi County'). Status: C. Yang in Huang et al. 1988: 197.

Dilar bolivari Navás, 1903 [Algeria, Tunisia]

Dilar bolivari Navás, 1903b: 116. Lectotype, male, MCNM, designated by Monserrat (1988a: 16). Type locality: Algeria: Oran [35°45'N 0°38'W]. Status: Monserrat 1988a: 16.

Dilar caesarulus H. Aspöck & U. Aspöck, 1967 [Afghanistan]

Dilar caesarulus H. Aspöck & U. Aspöck, 1967: 57. Holotype, male, ASPÖCK. Type locality: Afghanistan: 125 km SW of Ghazni [G = 33°33'N 68°28'E]. Status: H. Aspöck & U. Aspöck 1967: 57.

Dilar corsicus Navás, 1909 [France]

Dilar corsicus Navás, [1909a]: 636. Holotype, female, BMNH. Type locality: France: Corsica, 'La Foca' [=Foce, 41°38'N 9°04'E]. Status: Monserrat 1988a: 17.

Notes: Type citation by Navás (1925: 188).

Dilar budtzi Esben-Petersen, 1913: 27. Syntypes, male & female, repository unknown. Type locality: France: Corsica (island). Synonymy: H. Aspöck et al. 1980: 188.

Dilar dissimilis Navás, 1903 [Spain]

Dilar dissimilis Navás, 1903a: 374. Lectotype, male, MNHP, designated by Monserrat (1988b: 192). Type locality: Spain: Zaragoza: Monasterio Santa María de Veruela [41°48'N 1°42'W], near Moncayo (mountain) (as: 'Veruela (Zaragoza) al pie del Moncayo'). Status: Monserrat 1988b: 189.

Notes: See Legrand & Lachaise (1994: 88) for a detailed account of the lectotype.

Dilar nepos Navás, 1909b: 151. Lectotype, male, MNHP, designated by Legrand & Lachaise (1994: 90). Type locality: Spain: Zaragoza: Muel [41°28'N 1°04'W]. Synonymy: H. Aspöck et al. 1980: 188. Status: Monserrat 1988: 189. Notes: Earlier type citations by Navás (1925: 188) and Monserrat (1988b: 192).

Dilar kolbei Navás, [1909a]: 635. Lectotype, male, MNHP, designated by Navás (1925: 188). Type locality: Spain: Andalucía (region). Synonymy: H. Aspöck et al. 1980: 188. Status: Monserrat 1988: 189.

Notes: The type series of *kolbei* consisted of two male syntypes, both of which were originally contained in the ZMHB (Navás [1909a]: 635). One syntype, however, was apparently retained by Navás in his personal collection, and ultimately came to be deposited in the MNHP. Navás (1925: 188) clearly states that the specimen in the MNHP is the 'Type'. This statement constitutes a valid lectotype designation under Art. 74(b) of the Code, and fixes the MNHP specimen as the lectotype of *kolbei*. The subsequent designation of the ZMHB specimen as the lectotype by Legrand and Lachaise (1994: 89) is therefore invalid, Art. 74a(i). Navás ([1909a]: 635) statement: 'El tipo se halla en el museo de Berlín', is not a valid lectotype designation because it does not identify a single specimen as the type – Navás having earlier clearly referred to two specimens in this collection ('He visto dos ejemplares que del museo de Berlín ...'). It might be argued that Navás' 'tipo' statement referred to the single specimen remaining in the ZMHB after he removed the second specimen of the type series to his own personal collection. Under this interpretation, Navás' statement would constitute a holotype designation (which would then also invalidate the lectotype designation of Legrand & Lachaise). However, as Navás gives no indication that only one specimen remained in the ZMHB at the time of his writing, there is no concrete support for this interpretation. See also the discussion by Monserrat (1988b: 192), who treated the MNHP and ZMHB specimens as syntypes.

Dilar distinctus Nakahara, 1955 [Taiwan]

Dilar distinctus Nakahara, 1955b: 139. Holotype, male, NSMT. Type locality: Taiwan: Nantou: Sungkang (as: 'Tattaka'). Status: Stange & Wang 1997: 49.

Dilar dochaner H. Aspöck & U. Aspöck, 1968 [Afghanistan]

Dilar dochaner H. Aspöck & U. Aspöck, 1968: 5. Holotype, male, ASPÖCK. Type locality: Afghanistan: Kabul: Khurd-Kabul [34°24'N 69°24'E], SE of Kabul. Status: H. Aspöck & U. Aspöck 1968: 5.

Dilar dongchuanus C. Yang, 1986 [China]

Dilar dongchuanus C. Yang, 1986: 155. Holotype, male, BAU. Type locality: China: Yunnan: Dongchuan [26°24'N 103°08'E; =Tung-ch'uan, =Tungchwan, =Hweitsch, =Tangdan]. Status: C. Yang 1986: 155.

Dilar duelli U. Aspöck & H. Aspöck, 1995 [France]

Dilar duelli U. Aspöck & H. Aspöck, 1995: 50. Holotype, male, NHMW. Type locality: France: Var: Massif de l'Estérel, Col du Mistral, ENE of Fréjus, ca. 43°26'N 6°44'E. Status: U. Aspöck & H. Aspöck 1995: 50.

Dilar formosanus (Okamoto & Kuwayama, 1920)

[Taiwan]

Dilar formosanus Okamoto & Kuwayama, 1920: 341. Holotype, female, repository unknown. Type locality: Taiwan: 'Arisan' [=Chiayi Prefecture: Alishan or A-li-shan, 23°30'N 120°49'E]. Status: Stange & Wang 1997: 49.

Dilar geometroides H. Aspöck & U. Aspöck, 1968

[Nepal]

Dilar geometroides H. Aspöck & U. Aspöck, 1968: 3. Holotype, male, ZSM. Type locality: Nepal: 'Prov. Nr. 3 East, Sete'. Status: H. Aspöck & U. Aspöck 1968: 3.

Dilar grandis (Banks, 1931) [Malaysia (Sabah)]
comb. n.

Rexavius grandis Banks, 1931a: 413. Syntypes, male, mcz. Type locality: Malaysia: Sabah: Borneo, Mt. Kinabalu, Kamborangah.

Notes: See discussion under *Rexavius* above.

Dilar harmandi (Navás, 1909) [India]

Nepal harmandi Navás, [1909a]: 661. Holotype, male, MNHP. Type locality: India: West Bengal: Darjeeling [27°02'N 88°20'E] (as: 'Darjeeling en el Himalaya'). Status: H. Aspöck & U. Aspöck 1968: 3.

Notes: See Legrand & Lachaise (1994: 88) for a detailed account of the holotype; earlier type citation by H. Aspöck & U. Aspöck (1968: 3).

Dilar hikosanus Nakahara, 1955 [Japan]

Dilar hikosanus Nakahara, 1955b: 137. Holotype, male, probably in the NSMT. Type locality: Japan: Fukuoka / Oita: Kyushu (island), Hiko-san (mountain) [33°29'N 130°58'E] (as: 'Hikoson, Kyushu'). Status: Kuwayama 1962: 376.

Dilar bornei McLachlan, 1869 [India]

Dilar bornei McLachlan, 1869: 239. Syntype(s), male, BMNH. Type locality: Northwestern India. Status: Ghosh & Sen 1977: 281.

Notes: Type citation by H. Aspöck & U. Aspöck (1968: 3).

Dilar indicus Monserrat, 1989 [India]

Dilar indicus Monserrat, 1989: 420. Holotype, male, NHMB. Type locality: India: 'Cachemira, Rampur'. Status: Monserrat 1989: 420.

Dilar japonicus McLachlan, 1883 [Japan]

Dilar japonicus McLachlan, 1883: 220. Holotype, male, BMNH. Type locality: Japan: Fukushima: Honshu (island), Fukushima [37°44'N 140°28'E] (as: 'Japan (Fukushima in the main Island, ...)'). Status: Kuwayama 1962: 376.

Dilar nobirae Nakahara, 1914: 297. Syntype(s), sex(es) unknown, possibly in the NSMT. Type locality: Japan: Nara: Yoshino [34°21'N 135°51'E] (as: 'Yoshino, Province Yamato'). Synonymy: Nakahara 1955b: 134. Status: Kuwayama 1962: 376.

Dilar japonicus var. *gracilis* Kuwayama, 1921: 71. Syntype(s), male, Okamoto collection (current repository unknown). Type locality: Not fixed, see Notes. Synonymy: Nakahara 1955b: 134. Status: Kuwayama 1962: 376.

Notes: Kuwayama (1921: 80) mentions three specimens from southern Honshu (island), Japan, in the type series, all in the Okamoto collection.

Dilar juniperi Monserrat, 1988 [Spain]

Dilar juniperi Monserrat, 1988b: 198. Holotype, male, MONSERRAT. Type locality: Spain: Jaén: Collado de los Jardines [38°20'N 3°30'W]. Status: Monserrat 1988b: 198.

Dilar kanoi (Nakahara, 1955) [Taiwan]

Nepal kanoi Nakahara, 1955a: 6. Holotype, male, NSMT. Type locality: Taiwan: Nantou: Sungkang (as: 'Tattaka'). Status: Stange & Wang 1997: 49.

Dilar kirgisis H. Aspöck & U. Aspöck, 1967 [Kirgizia]

Dilar kirgisis H. Aspöck & U. Aspöck, 1967: 59. Holotype, male, ASPÖCK. Type locality: Kirgizia: Issyk-Kul (lake). Status: Zakharenko 1988: 764.

Dilar lineolatus Navás, 1909 [Turkey] Nomen dubium

Dilar lineolatus Navás, [1909a]: 645. Syntype(s), female, ZMHB. Type locality: Turkey: Tekke [40°08'N 29°41'E] [as 'Tekke en la Turcomania']. Status: Monserrat 1988a: 20. Notes: Earlier type citation by H. Aspöck & U. Aspöck (1968: 3).

Dilar marmoratus (Banks, 1931) [Thailand] comb. n.

Rexavius marmoratus Banks, 1931b: 385. Syntypes, male & female, mcz. Type locality: Thailand: Nakhon Si Thammarat [8°24'N 99°58'E], Khao Luang (mountain) [8°31'N 99°47'E] (as: 'Peninsular Siam: Nakon Sri Tamarat, Khao Luang').

Notes: See discussion under *Rexavius* above.

Dilar megalopterus C. Yang, 1986 [China]

Dilar megalopterus C. Yang, 1986: 154. Holotype, male, BAU. Type locality: China: Yunnan: Dongchuan [26°24'N 103°08'E; =Tung-ch'uan, =Tungchwan, =Hweitsch, =Tangdan]. Status: C. Yang 1986: 154.

Dilar meridionalis Hagen, 1866 [Andorra, France, Spain]

Dilar meridionalis Hagen, 1866a: 295. Holotype, sex unknown, repository unknown. Type locality: Spain: probably from the Sierra Nevada (mountains) near Granada.

Status: Monserrat 1988b: 184.

Notes: The original description does not indicate where the single specimen of the type series of *meridionalis* was collected. Hagen (1866b: 402) subsequently cited the species from Spain, and McLachlan (1869: 239) states the type locality as 'the Sierra Nevada in the South of Spain'.

Dilar pictus Navás, 1903a: 377. Holotype, female, MCNM. Type locality: Spain: Madrid: near Madrid [M = 40°25'N 3°43'W]. Synonymy: Navás 1909a: 652 (as a variety of *meridionalis*). Status: Monserrat 1988b: 185.

Notes: Subsequently incorrectly cited as a new name by Navás ([1909a]: 652).

Dilar nemorosus Navás, 1909b: 153. Syntype(s), male, repository unknown (see Notes). Type locality: Spain: Huesca: Sierra de Guara (mountains) near the Santuario de San Cosme [SdSC = 42°15'N 0°16'W] (as: 'Sierra de Guara (Huesca), cerca del santuario de San Cosme'). Synonymy: Navás [1924]: 229. Status: Monserrat 1988b: 185.

Notes: Types presumed lost or destroyed. Probably formerly in the Navás collection. Types not listed by Monserrat (1985) as being in the remnants of the Navás collection in the MZB.

Dilar mateui Réal, 1968: 111. Holotype, male, REAL. Type locality: France: Pyrénées-Orientales: 'Vallée de Nohèdes' [Nohèdes (town) = ca. 11 km W of Prades, P=42°38'N 2°25'E]. Synonymy: H. Aspöck et al. 1980: 189. Status: Monserrat 1988b: 185.

Dilar montanus C. Yang, 1992 [China]

Dilar montanus C. Yang, 1992b: 441. Holotype, male, IZASB. Type locality: China: Szechwan [=Sichuan]: Zhonggrewu, Xiangcheng [X = 28°54'N 99°40'E; = Hsiang-ch'eng, = Hsiangcheng]. Status: C. Yang 1992b: 441.

Dilar nevadensis Rambur, 1838 [Spain]

Dilar nevadensis Rambur, [1838]: pl. 9. Syntype(s), sex(es) unknown, ISNB. Type locality: Spain: Granada: Sierra Nevada (mountains), near Granada [G = 37°10'N 3°35'W] (as: 'aux environs de Grenade, dans les petits bois des parties élevée de la Sierra-Nevada'). Status: Monserrat 1988b: 182.

Notes: Type locality from Rambur (1842: 446). At least two syntypes are stated by Navás ([1909a]: 632) to be in the ISNB. Navás ([1909a]: 629) cites his earlier use of the name '*nivatensis*' as an error for *Dilar nevadensis* Rambur.

Cladocera marmoratus Hagen, 1860: 56, nomen nudum. Status: Hagen 1866b: 399.

Notes: '*Cladocera marmorata* Hoffm. Mus. Berol.' was cited by Hagen (1860: 56) without description, definition or indication, and is therefore unavailable, Art. 12a. The binomen *Cladocera marmorata* apparently originated as a manuscript name that was recorded by Hagen from the identification label of a specimen in the Hoffmansegg Collection of the Museum für Naturkunde, Humboldt Universität, Berlin. Hagen (1866b: 399) subsequently synonymized *Cladocera* with *Dilar*, and *C. marmorata* with *Dilar nevadensis* Rambur, without either name ever having been made available.

Dilar nietneri Hagen, 1858 [Sri Lanka]

Dilar nietneri Hagen, 1858b: 482. Syntype(s), sex(es) unknown, ZMHB. Type locality: Sri Lanka: 'Rainbodde'. Status: H. Aspöck & U. Aspöck 1968: 3.

Notes: Type citations by Navás ([1909a]: 664) and H.

Aspöck & U. Aspöck (1968: 3).

Dilar pallidus Nakahara, 1955 [Taiwan]

Dilar pallidus Nakahara, 1955b: 140. Holotype, male, NSMT. Type locality: Taiwan: Nantou: Sungkang (as: 'Tattaka'). Status: Stange & Wang 1997: 49.

Dilar parthenopaeus A. Costa, 1855 [Italy]

Dilar parthenopaeus A. Costa, 1855: 19. Lectotype, male, MZUN. Type locality: Italy: Campania: Salerno: Cava de' Tirreni [40°42'N 14°42'E]. Status: H. Aspöck et al. 1980: 190.

Notes: Type locality information and lectotype designation from Pantaleoni (pers. comm.; data from manuscript in preparation on Costa types).

Dilar pumilus Navás, 1903 [Spain]

Dilar pumilus Navás, 1903a: 380. Holotype, male, MNHP. Type locality: Spain: Murcia: near Cartagena [C = 37°36'N 0°59'W]. Status: Monserrat 1988b: 195.

Notes: See Legrand & Lachaise (1994: 90) for a detailed account of the holotype; earlier type citations by Navás (1925: 188) and Monserrat (1988b: 195).

Dilar pusillus C. Yang in Huang et al., 1992 [China]

Dilar pumilus C. Yang in Huang et al., 1988: 197. Holotype, male, probably in the BAU or IZASB. Type locality: China: Tibet [=Xizang]: Medog County, Beibeng. Status: C. Yang 1992a: 379.

Notes: A junior primary homonym of *Dilar pumilus* Navás, 1903. The objective replacement name is *Dilar pusillus* C. Yang, 1992.

Dilar pusillus C. Yang, 1992a: 379. Status: C. Yang 1992a: 379.

Notes: An objective replacement name for *Dilar pumilus* C. Yang in Huang et al., 1988, nec Navás, 1903.

Dilar saldubensis Navás in Laguna, 1902 [Portugal, Spain]

Dilar saldubensis Navás in Laguna, 1902: 134. Neotype, male, MNHP, designated by Monserrat 1988b: 188. Type locality: Spain: Zaragoza: Zaragoza [41°39'N 0°54'W]. Status: Monserrat 1988b: 187.

Notes: The original type series was formerly in the Navás collection. The specimens of this series are not present in the remnants of the Navás collection in the MZB (Monserrat 1985), and are now presumed lost or destroyed. See also Legrand & Lachaise (1994: 90) for a detailed account of the neotype.

Dilar campestris Navás, 1903a: 380. Lectotype, male, MNHP, designated by Legrand & Lachaise (1994: 88). Type locality: Spain: Ciudad Real: Pozuelo de Calatrava [38°55'N 3°50'W]. Synonymy: H. Aspöck et al. 1980: 189. Status: Monserrat 1988b: 187.

Notes: Earlier type citations by Navás (1925: 188) and Monserrat (1988b: 188).

Fuentenus lusitanicus Navás, [1909a]: 660. Holotype, sex unknown, ZMHB. Type locality: Northern Portugal. Synonymy: Navás [1924]: 232 (as a synonym of *campestris*). Status: Monserrat 1988b: 188.

Notes: Type in poor condition and missing its abdomen. This species was considered to be a nomen dubium by

Monserrat (1988b: 188), but he accepted Navás' ([1924]: 232) synonymy of *lusitanicus* with *campestris*.

***Dilar septentrionalis* Navás, 1912 [China, Korea, Russia]**

Dilar septentrionalis Navás, 1912: 420. Lectotype, male, MNHP, designated by Monserrat (1988a: 20). Type locality: Russia: Vladivostok [43°09'N 131°53'E]. Status: Makarkin 1990: 38.

Notes: See Legrand & Lachaise (1994: 91) for a detailed account of the lectotype.

***Dilar similis* Monserrat, 1989 [Pakistan]**

Dilar similis Monserrat, 1989: 419. Holotype, male, NHMB. Type locality: Pakistan: North-West Frontier: 'Salf-ui-Maluk Sar'. Status: Monserrat 1989: 419.

***Dilar sinicus* Nakahara, 1957 [China]**

Dilar sinicus Nakahara, 1957: 31. Holotype, male, probably in the NSMT. Type locality: China: Shansi: between Henglingkuan [35°25'N 111°36'E; =Heng-ling-kuan, =Henglingguan] and Wangmaochen. Status: Nakahara 1957: 31.

***Dilar subdolos* Navás, 1932 [China] Nomen dubium**

Dilar subdolos Navás, 1932: 921. Holotype, male, repository unknown (see Notes). Type locality: China: Kiangsu: Chinkiang [32°03'N 119°26'E; =Chen-chiang, =Chenkiang, =Zhenjiang]. Status: Monserrat 1988a: 22.

Notes: Holotype formerly in the Navás collection, now presumed lost or destroyed. Type not listed by Monserrat (1985) as being in the remnants of the Navás collection in the MZB.

***Dilar syriacus* Navás, 1909 [Syria] Nomen dubium**

Dilar syriacus Navás, [1909a]: 644. Holotype, male, MNHP. Type locality: Lebanon: near Beirut [B = 33°52'N 35°30'E] (as: 'Siria, Creo que es de los alrededores de Beirut'). Status: Monserrat 1988a: 19.

Notes: See Legrand & Lachaise (1994: 91) for a detailed account of the holotype.

***Dilar taiwanensis* Banks, 1937 [Taiwan]**

Dilar taiwanensis Banks, 1937: 276. Syntype(s), sex(es) unknown, probably in the MCZ. Type locality: Taiwan: Chiayi [=Chia-i]: Alishan [=A-li-shan, 23°30'N 120°49'E] (as: 'Arizan'). Status: Stange & Wang 1997: 49.

***Dilar tibetanus* C. Yang, 1987 [China]**

Dilar tibetanus C. Yang, 1987: 197. Holotype, male, probably in the BAU or IZASB. Type locality: China: Tibet: Bomi Co., Yigang. Status: C. Yang 1987: 197.

***Dilar turcicus* Hagen, 1858 [Southern Europe from Yugoslavia east to Dagestan (Russia)]**

Dilar turcicus Hagen, 1858a: 129. Holotype, sex unknown, repository unknown. Type locality: Turkey. Status: H. Aspöck et al. 1980: 190.

Dilar corcyraeus Navás, [1909a]: 642. Holotype, female, NHMW. Type locality: Greece: Corfu (island). Synonymy: H. Aspöck et al. 1980: 190. Status: Monserrat 1988a: 19.

***Dilar vartianorum* H. Aspöck & U. Aspöck, 1967 [Afghanistan]**

Dilar vartianorum H. Aspöck & U. Aspöck, 1967: 57. Holotype, male, ASPÖCK. Type locality: Afghanistan: Nuristan, 25 km N of Barikot [B = 35°18'N 71°36'E]. Status: H. Aspöck & U. Aspöck 1967: 57.

***Dilar vietnamensis* Zakharenko, 1991 [Vietnam]**

Dilar vietnamensis Zakharenko, 1991: 142. Holotype, male, ZMUM. Type locality: Vietnam: 'Onang Ninh, Dongkho'. Status: Zakharenko 1991: 142.

***Dilar wangi* C. Yang, 1992 [China]**

Dilar wangi C. Yang, 1992b: 441. Holotype, male, IZASB. Type locality: China: Yunnan: Wengshui, Zhongdian [Z = 27°46'N 99°45'E; =Chung tien]. Status: C. Yang 1992b: 441.

***Dilar yunnanus* C. Yang, 1986 [China]**

Dilar yunnanus C. Yang, 1986: 154. Holotype, male, BAU. Type locality: China: Yunnan: Dehong Dai-Jingpo [=Tehung Shan-kachin] Autonomous District: Ruili [24°01'N 97°52'E; =Jui-li]. Status: C. Yang 1986: 154.

Genus *Neonallachius* Nakahara, 1963

Neonallachius Nakahara, 1963: 77. Type species: *Neonallachius annandalei* Nakahara, 1963: 77, by original designation. Etymology: Unexplained, probably Neo- (< *neos*, new) – -*nallachius* (< *Nallachius*, a dilarid genus-group name). Gender: Masculine, no originally attributed or implied gender, here considered masculine, Art. 30d. Status: Oswald & Penny 1991: 42.

Species and distribution. – 1 species; India, Sri Lanka; see Hynd (1992), Nakahara (1963).

Reviews, revisions and keys. – None.

Biology and immature stages. – Unknown.

***Neonallachius annandalei* Nakahara, 1963 [India]**

Neonallachius annandalei Nakahara, 1963: 77. Holotype, male, NZSI. Type locality: India: Orissa: Barkuda Island, Chilka Lake, near Ganjam [G = 19°28'N 85°05'E]. Status: Adams 1970: 7.

Subfamily Nallachiinae Navás, 1914

Nallachini Navás, 1914: 11 (as a tribe of the Dilaridae).

Type genus: *Nallachius* Navás, 1909. Notes: Name incorrectly formed from the type genus.

Nallachiini – Carpenter, 1947: 100 (as a tribe of the Dilaridae). Type genus: *Nallachius* Navás, 1909.

Nallachiinae – Adams, 1970: 8 (as a subfamily of the Dilaridae). Type genus: *Nallachius* Navás, 1909.

Species and distribution. – See *Nallachius* below.

Reviews, revisions and keys. – See *Nallachius* below.

Biology and immature stages. – See *Nallachius* below.

Genus *Nallachius* Navás, 1909

Nallachius Navás, [1909a]: 666. Type species: *Dilar prestoni* McLachlan, 1880: 39, by subsequent designation by

Navás 1914: 11. Etymology: An anagram of Lachlanus, from the Latinized surname of Robert McLachlan, English entomologist, see Navás ([1909a]: 665). Gender: Masculine, inferred from the combination '*Nallachus americanus*', Art. 30d. Status: Oswald & Penny 1991: 39.

Nulema Navás, 1914: 12. Type species: *Nulema championi* Navás, 1914: 12, by monotypy. Etymology: An arbitrary combination of letters, see Navás (1914: 12). Gender: Feminine, no originally attributed or implied gender, here considered a natural Latin feminine, Art. 30d. Synonymy: Adams 1970: 8. Status: Oswald & Penny 1991: 39. Known incorrect subsequent spellings: *Nurema*.

Neodilar Carpenter, 1947: 107. Type species: *Dilar hermosa* Banks, 1913: 220, by original designation. Etymology: Unexplained, probably Neo- (< Gr. *neos*, new) – *dilar* (< *Dilar*, a dilarid genus-group name). Gender: Masculine, no originally attributed or implied gender, here considered masculine, Art. 30d. Synonymy: Adams 1970: 8. Status: Oswald & Penny 1991: 39.

Species and distribution. – 19 species; Eastern United States south to Argentina, including the West Indies (17 spp.), southern Africa (1 sp.) and Vietnam (1 sp.); see Adams (1970), Hoffman (1990), Maes & Flint (1994), Penny ([1978], [1982]), Penny et al. (1997).

Reviews, revisions and keys. – Carpenter 1940 (Nearctic, review); Carpenter 1947 (New World, review); Adams 1970 (New World, revision, key); Penny [1982] (Amazon Basin, review, key).

Biology and immature stages. – Steyskal 1944 (*americanus*: biology); Gurney 1947 (*americanus*: biology, egg, larva, pupa, figs); Peterson 1967 (*americanus*: larva, fig); MacLeod & Spiegler 1961 (*americanus*: biology, egg, larva); Tauber 1991 (*americanus*: larva, fig); MacLeod 1964 (*americanus*: larva, figs); Gepp 1984 (*americanus*: larva, fig); Minter 1992 (*krooni*: egg, larva, figs).

Nallachus adamsi Penny, 1982 [Brazil]

Nallachus adamsi Penny, [1982]: 385. Holotype, male, INPA. Type locality: Brazil: Amazonas: Manaus [3°06'S 60°00'W]. Status: Penny [1982]: 385.

Nallachus americanus (McLachlan, 1881) [Eastern USA south to Venezuela, West Indies]

Dilar americanus McLachlan, 1881: 55. Holotype, female, MCZ. Type locality: USA: Kentucky: Edmonson Co.: Bee Spring [37°17'N 86°17'W]. Status: Penny et al. 1997: 63. Notes: Type citation by Adams (1970: 27).

Nallachus bruchi Navás, 1923 [Argentina]

Nallachus bruchi Navás, 1923: 195. Holotype, female, repository unknown (see Notes). Type locality: Argentina: Córdoba: Alta Gracia [31°42'S 64°25'W]. Status: Penny [1978]: 30.

Notes: Holotype formerly in the Navás collection, now presumed lost or destroyed. Type not listed by Monsetrat (1985) as being in the remnants of the Navás collection in the MZB.

Nallachus championi (Navás, 1914) [Guatemala]

Nulema championi Navás, 1914: 12. Lectotype, male, BMNH, designated by Adams (1970: 22). Type locality:

Guatemala: Cerro Zunil [14°44'N 91°27'W]. Status: Penny [1978]: 30.

Nallachus bicolor Adams, 1970 [Argentina, Brazil]

Nallachus bicolor Adams, 1970: 19. Holotype, male, PMY. Type locality: Brazil: Santa Catarina: Nova Teutonia, 27°11'S 52°23'W. Status: Penny [1978]: 30.

Nallachus hermosa (Banks, 1913) [Colombia]

Dilar hermosa Banks, 1913: 220. Holotype, female, MCZ. Type locality: Colombia: Cundinamarca: Cordillera Oriental, Pacho [5°09'N 74°08'W]. Status: Penny [1978]: 30. Notes: Type citation by Adams (1970: 25).

Nallachus infuscatus Penny, 1982 [Brazil]

Nallachus infuscatus Penny, [1982]: 386. Holotype, male, INPA. Type locality: South Africa: Transvaal: Cordillera Oriental, Pacho [2°54'S 59°57'W], 26 km N of Manaus [3°07'S 60°02'W]. Status: Penny [1982]: 386.

Nallachus krooni Minter, 1986 [Malawi, Namibia, South Africa]

Nallachus krooni Minter, 1986: 88. Holotype, male, NCIP. Type locality: South Africa: Transvaal: Wylliespoort, 22°55'S 29°56'E. Status: Minter 1986: 88.

Nallachus limai Adams, 1970 [Brazil]

Nallachus limai Adams, 1970: 23. Holotype, male, PMY. Type locality: Brazil: Santa Catarina: Nova Teutonia, 27°11'S 52°23'W. Status: Penny [1978]: 30.

Nallachus loxanus Navás, 1911 [Ecuador]

Nallachus loxanus Navás, 1911: 219. Holotype, male, MNHP. Type locality: Ecuador: Loja: Loja [3°59'S 79°16'W] (as: 'Équateur, Loja'). Status: Penny [1978]: 30. Notes: See Legrand & Lachaise (1994: 89) for a detailed account of the holotype.

Nallachus maculatus Penny, 1982 [Brazil]

Nallachus maculatus Penny, [1982]: 389. Holotype, male, INPA. Type locality: Brazil: Rondonia: 48 km E of Porto Velho [PV = 8°45'S 63°54'W]. Status: Penny [1982]: 389.

Nallachus ovalis Adams, 1970 [Brazil]

Nallachus ovalis Adams, 1970: 17. Holotype, male, PMY. Type locality: Brazil: Santa Catarina: Nova Teutonia, 27°11'S 52°23'W. Status: Penny [1978]: 30.

Nallachus parkeri Penny, 1994 [Costa Rica]

Nallachus parkeri Penny, 1994: 309. Holotype, male, INBIO. Type locality: Costa Rica: Guanacaste: 3 km SE of Rio Naranjo (town) [RN = 10°41'N 85°06'W]. Status: Penny 1994: 309.

Nallachus phantomellus Adams, 1970 [Brazil]

Nallachus phantomellus Adams, 1970: 12. Holotype, male, PMY. Type locality: Brazil: Mato Grosso do Sul: Rio Caraguatã, 21°48'S, 52°27'W. Status: Penny [1978]: 30.

Nallachus ponomarenkoi Zakharenko, 1991 [Vietnam]

Nallachus ponomarenkoi Zakharenko, 1991: 143. Holotype, male, ZMUM. Type locality: Vietnam: Kien Giang: 'Tho Tu'. Status: Zakharenko 1991: 143.

Nallachus prestoni (McLachlan, 1880) [Brazil]

Dilar prestoni McLachlan, 1880: 39. Holotype, male, BMNH.

Type locality: Brazil: Rio de Janeiro: near Rio de Janeiro [RdJ = 22°53'S 43°17'W]. Status: Penny [1978]: 30.

Notes: Type citation by Adams (1970: 17).

Nallachius pulchellus (Banks, 1938) [Southwestern USA, Cuba, Costa Rica]

Dilar (*Nallachius*) *pulchellus* Banks, 1938: 289. Holotype, male, mcz. Type locality: Cuba: Cienfuegos: Soledad, near Cienfuegos [C = 22°10'N 80°27'W]. Status: Penny et al. 1997: 62.

Notes: Type citation by Adams (1970: 14).

Nallachius pupillus (Navás, 1930) [Paraguay]

Nulema pupillus Navás, 1930: 62. Holotype, male, ZMHA (see Notes). Type locality: Paraguay: Cordillera: San Bernardino [25°16'S 57°16'W]. Status: Penny [1978]: 30.

Notes: Type citation by Adams (1970: 29). Type presumed destroyed in the Hamburg Museum during WWII.

Nallachius reductus Carpenter, 1947 [Paraguay]

Nallachius reductus Carpenter, 1947: 104. Holotype, male, mcz. Type locality: Paraguay: Italyria (as: 'Ualyaia, Paraguay'). Status: Penny [1978]: 30.

Notes: Type citation by Adams (1970: 15).

TAXA REMOVED FROM THE DILARIDAE

Berotha bannana (C. Yang, 1986) [China] comb. n.

Berothella bannana C. Yang, 1986: 156. Holotype, female, BAU. Type locality: China: Yunnan: Xishuangbanna Dai [=Hsi-shuang-pan-na Thai] Autonomous District, Menghai [21°59'N 100°35'E; = Meng-hai].

Notes: Yang's figure clearly shows that this species belongs in the Berothidae, where it appears to be a species of the genus *Berotha* (U. Aspöck, pers. comm.). The species is here transferred to the Berothidae under the new combination *Berotha bannana*.

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INDICES

(valid names italicized)

Genus-group name	valid genus
<i>Berothella</i> Banks	<i>Berothella</i>
Cladocera Hagen	<i>Dilar</i>
<i>Dilar</i> Rambur	<i>Dilar</i>
Fuentenus Navás	<i>Dilar</i>
Lidar Navás	<i>Dilar</i>
<i>Nallachius</i> Navás	<i>Nallachius</i>
Neodilar Carpenter	<i>Nallachius</i>

<i>Neonallachius</i> Nakahara	<i>Neonallachius</i>
Nepal Navás	<i>Dilar</i>
Nulema Navás	<i>Nallachius</i>
Rexavius Navás	<i>Dilar</i>

Species-group name	valid species
<i>adamsi</i> Penny	<i>Nallachius adamsi</i>
<i>algericus</i> Navás	<i>Dilar algericus</i>
<i>americanus</i> McLachlan	<i>Nallachius americanus</i>
<i>annandalei</i> Nakahara	<i>Neonallachius annandalei</i>
<i>asperus</i> C. Yang in Huang et al.	<i>Dilar asperus</i>
<i>bannana</i> C. Yang	<i>Berothella bannana</i>
<i>bolivari</i> Navás	<i>Dilar bolivari</i>
<i>bruchii</i> Navás	<i>Nallachius bruchii</i>
<i>budtzi</i> Esben-Petersen	<i>Dilar corsicus</i>
<i>caesarulus</i> H. Aspöck & U. Aspöck	<i>Dilar caesarulus</i>
<i>campestris</i> Navás	<i>Dilar saldubensis</i>
<i>championi</i> Navás	<i>Nallachius championi</i>
<i>corcyraeus</i> Navás	<i>Dilar turcicus</i>
<i>corsicus</i> Navás	<i>Dilar corsicus</i>
<i>dicolor</i> Adams	<i>Nallachius dicolor</i>
<i>dissimilis</i> Navás	<i>Dilar dissimilis</i>
<i>distinctus</i> Nakahara	<i>Dilar distinctus</i>
<i>dochaner</i> H. Aspöck & U. Aspöck	<i>Dilar dochaner</i>
<i>dongchuanus</i> C. Yang	<i>Dilar dongchuanus</i>
<i>duelli</i> U. Aspöck & H. Aspöck	<i>Dilar duelli</i>
<i>formosanus</i> Okamoto & Kuwayama	<i>Dilar formosanus</i>
<i>geometroides</i> H. Aspöck & U. Aspöck	<i>Dilar geometroides</i>
<i>gracilis</i> Kuwayama	<i>Dilar japonicus</i>
<i>grandis</i> Banks	<i>Dilar grandis</i>
<i>harmandi</i> Navás	<i>Dilar harmandi</i>
<i>hermosa</i> Banks	<i>Nallachius hermosa</i>
<i>hikosanus</i> Nakahara	<i>Dilar hikosanus</i>
<i>hornei</i> McLachlan	<i>Dilar hornei</i>
<i>indicus</i> Monserrat	<i>Dilar indicus</i>
<i>infuscatus</i> Penny	<i>Nallachius infuscatus</i>
<i>japonicus</i> McLachlan	<i>Dilar japonicus</i>
<i>juniperi</i> Monserrat	<i>Dilar juniperi</i>
<i>kanoi</i> Nakahara	<i>Dilar kanoi</i>
<i>kirgisus</i> H. Aspöck & U. Aspöck	<i>Dilar kirgisus</i>
<i>kolbei</i> Navás	<i>Dilar dissimilis</i>
<i>krooni</i> Minter	<i>Nallachius krooni</i>
<i>limai</i> Adams	<i>Nallachius limai</i>
<i>lineolatus</i> Navás	<i>Dilar lineolatus</i>
<i>loxanus</i> Navás	<i>Nallachius loxanus</i>
<i>lusitanicus</i> Navás	<i>Dilar saldubensis</i>
<i>maculatus</i> Penny	<i>Nallachius maculatus</i>
<i>marmoratus</i> Banks	<i>Dilar marmoratus</i>
<i>marmoratus</i> Hagen	<i>Dilar nevadensis</i>
<i>mateui</i> Réal	<i>Dilar meridionalis</i>
<i>megalopterus</i> C. Yang	<i>Dilar megalopterus</i>
<i>meridionalis</i> Hagen	<i>Dilar meridionalis</i>
<i>montanus</i> C. Yang	<i>Dilar montanus</i>
<i>nemorosus</i> Navás	<i>Dilar meridionalis</i>

nepos Navás *Dilar dissimilis*
nevadensis Rambur *Dilar nevadensis*
nietneri Hagen *Dilar nietneri*
nohirae Nakahara *Dilar japonicus*
ovalis Adams *Nallachius ovalis*
pallidus Nakahara *Dilar pallidus*
parkeri Penny *Nallachius parkeri*
parthenopaeus A. Costa *Dilar parthenopaeus*
phantoma Banks *Berothella phantoma*
phantomellus Adams *Nallachius phantomellus*
pictus Navás *Dilar meridionalis*
ponomarenkoi Zakharenko *Nallachius ponomarenkoi*
prestoni McLachlan *Nallachius prestoni*
pretiosa Banks *Berothella pretiosa*
pulchellus Banks *Nallachius pulchellus*
pumilus C. Yang in Huang et al. ... *Dilar pusillus*
pumilus Navás *Dilar pumilus*
pupillus Navás *Nallachius pupillus*
pusillus C. Yang *Dilar pusillus*
reductus Carpenter *Nallachius reductus*
saldubensis Navás in Laguna ... *Dilar saldubensis*
septentrionalis Navás *Dilar septentrionalis*
similis Monserrat *Dilar similis*
sinicus Nakahara *Dilar sinicus*
subdolosus Navás *Dilar subdolosus*
syriacus Navás *Dilar syriacus*
taiwanensis Banks *Dilar taiwanensis*
tibetanus C. Yang *Dilar tibetanus*
turcicus Hagen *Dilar turcicus*
vartianorum H. Aspöck & U. Aspöck
 *Dilar vartianorum*
vietnamensis Zakharenko *Dilar vietnamensis*
wangi C. Yang *Dilar wangi*
yunnanus C. Yang *Dilar yunnanus*

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NEW SPECIES OF *SICODERUS* VANIN FROM THE VIRGIN ISLANDS (COLEOPTERA: CURCULIONIDAE; CURCULIONINAE; OTIDOCEPHALINI)

Anderson, R. S. 1999. New species of *Sicoderus* Vanin from the Virgin Islands (Coleoptera: Curculionidae; Curculioninae; Otidocephalini). – Tijdschrift voor Entomologie 141 [1998]: 129-135, figs. 1-12. [ISSN 0040-7496]. Published 1 March 1999.

Three new species of the genus *Sicoderus* Vanin from the Virgin Islands of the Greater Antilles are described. The three new species are *Sicoderus ivieorum* sp. n., *S. hirsutiventris* sp. n., and *S. vanini* sp. n. They are placed in the *S. tinamus* species group and compared with known West Indian *Sicoderus*. A key to all *Sicoderus* in the West Indies (including Florida) is presented.

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Key words. – Weevil; biogeography; inventory; West Indies

The genus *Sicoderus* is well-represented in the islands of the West Indies with ten recognized species in two species groups found there (Vanin 1986). The four members assigned to the *S. delauneyi* group are found on the islands of the Lesser Antilles as far north as Guadeloupe, whereas the six species of the *S. tinamus* group are known from southern Florida and the Bahamas, Cuba and Hispaniola. Recent collections of *Sicoderus* from the British and U.S. Virgin Islands (and Puerto Rico) bridge the geographical gap between the ranges of species in these two groups and represent three undescribed species in the *S. tinamus* species group.

Descriptions of these new species follow the format used in Vanin (1986) to facilitate comparisons with species treated therein. A revised key to all *Sicoderus* species occurring in southern Florida, the Bahamas and the West Indies is presented.

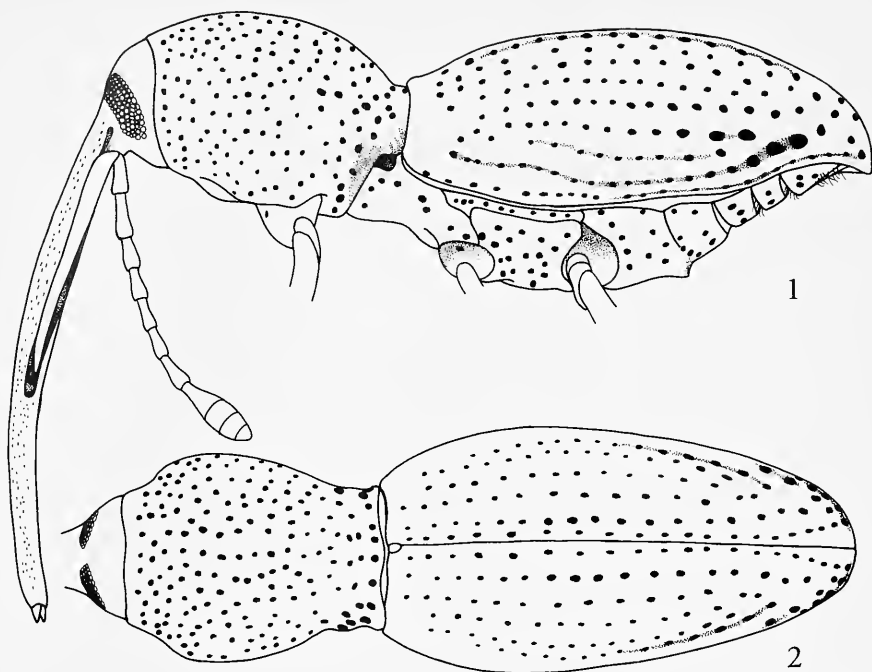
Specimens are deposited in the Canadian Museum of Nature, Ottawa, Ontario, Canada (CMNC), the collection of Charles W. O'Brien, Tallahassee, FL. (CWOB), the collection of Michael A. Ivie, Bozeman, MT. (MAIC), and the United States National Museum, Washington D.C. (USNM).

Sicoderus ivieorum sp. n. (figs. 1-5)

Description

Length male, 5.2-6.2 mm; female, 4.8-7.2 mm. Integument black, shining. Rostrum $0.97\text{--}1.00\times$ length elytra in male; $1.09\text{--}1.17\times$ length elytra in female.

Antennal insertion submedial in male and female. Antenna with article II of funicle $1.49\text{--}1.57\times$ length article III in male; $1.27\text{--}1.29\times$ length article III in female. Prothorax with length $1.17\text{--}1.19\times$ width in male; $1.23\text{--}1.26\times$ width in female. Prothorax constricted anteriorly, globose, widest at anterior one-third; punctures well-separated, sparse, very fine and shallow on disk, slightly deeper and larger in anterior one-quarter and very slightly deeper on flanks; with scattered, erect setae along anterior constriction. Elytra with length $1.86\text{--}1.88\times$ width in male; $1.88\text{--}1.93\times$ width in female; in dorsal view distinctly widest at midlength, lateral margins convergent both anteriorly and posteriorly; humeri fully reduced, not at all angulate; with isolated, erect but short (perhaps abraded or broken), setae in sutural region; apices conjointly rounded. Strial punctures evident, shallow, moderately fine. Membranous wings lacking. Metasternum with punctures well-separated, moderately fine and shallow; first row of punctures alongside metepisternum consisting of 3 or 4 widely spaced, shallow punctures. Abdominal ventrite I of male moderately raised in middle near apical margin forming a moderately elevated tubercle with two small subcontiguous patches of setosity at tip; of female, moderately swollen in middle near apical margin but not tuberculate, not setose. Ventrite V of male with rounded shallow impression in apical three-quarters; of female, uniformly convex. Legs with all femora with distinct ventral tooth; tooth slightly larger on anterior legs; tarsal claws with small basal tooth. Aedeagus with shallow apical notch; slightly expanded laterally near apex; in-



Figs. 1-2. *Sicoderus ivieorum* sp. n., male – 1, lateral habitus; 2, dorsal habitus.

ternal sac with complex of denticles and sclerites. Female not dissected.

Type material. – Holotype male, labelled: 'VIRGIN IS: St. John / Est. Caneel Bay, Caneel / Hill Trail fr. Center / line Rd. 580-600ft / 02NOV1992, M.A. Ivie' (USNM). – Allotype female (USNM) labelled as holotype. – Paratypes: 7 males, 3 females. – VIRGIN ISLANDS: St. John Est., Caneel Bay, Caneel Hill Trail fr. Center line Rd. 580-600ft., 2 nov 1992, M. A. Ivie (1 ♂, MAIC); St. John Est. Lameshur Bay, Europa-Lt. Lameshur Bay, 25 July 1994, M. S. Becker, at night (1 ♀, CMNC); St. John Est., Lameshur Bay, Reef Bay Tr. Europa- Lameshur Bays, 25 July 1994 M.S. Becker, night beating (1 ♂, CMNC); St. John Est., Hammer-Farm, Cinnamon Bay Trail, 17 July 1994, M.S. Becker, beating veg (1 ♀, MAIC); St. John Est., Molledahl, 15 July 1994, Petroglyph Trail, leaf litter nr. fresh water, M. S. Becker (1 ♂, CMNC); St. John Est., Hope, Reef Bay Trail, 20 July 1994, M. S. Becker colr, beating vegetation (1 ♂, MAIC). – BRITISH VIRGIN ISLANDS: Jost Van Dyke, White Bay, 24 July 1994, M. A. Ivie, beating dead catch-n-keep vines (2 ♂, CMNC, MAIC); Tortola, Windy Hill, 24-29 dec 1993, 300-500', thorn-scrub for., T.K. Phillips colr. (1 ♂, 1 ♀, CMNC, MAIC).

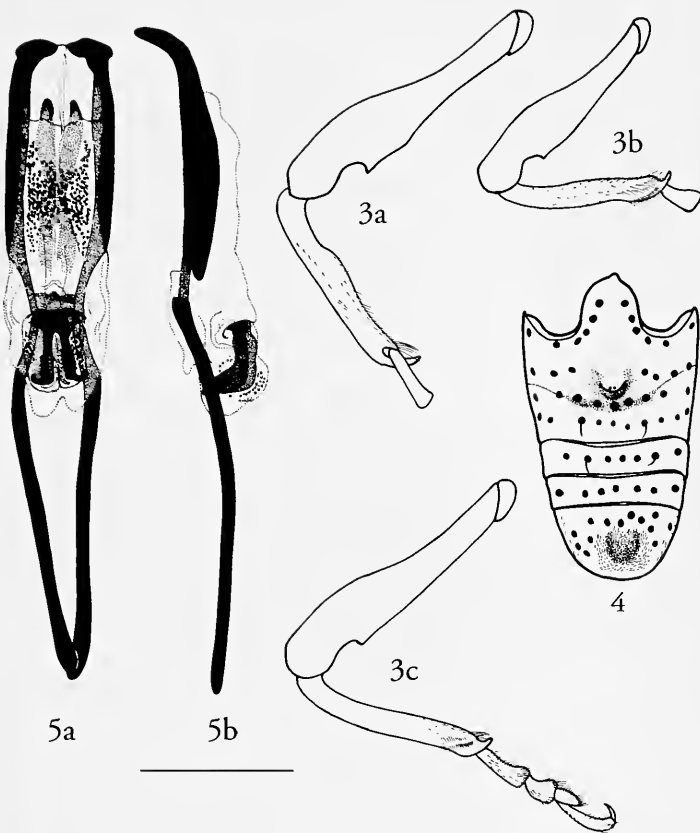
A single female specimen labelled 'PUERTO RICO: Guanica For. Res. 26sep1987, M.A. Ivie colr. 33m, beating, thorn scrub' appears to represent this same species. It is not included in the type series as males need to be examined to confirm conspecificity. As Puerto Rico and St. John are part of the Puerto Rican Bank (an old continental plate) and are not separated by deep water, such a distribution would not be surprising.

Derivation of specific name

This species is named for Michael and Donna Ivie who have worked extensively on increasing our knowledge of West Indian, especially Virgin Islands, insects.

Comments

Sicoderus ivieorum can be distinguished from other *Sicoderus* in the West Indies by the following combination of character states: presence of distinct femoral teeth; elytra with humeri fully reduced and not at all angulate; sparse and fine punctures of the pronotal disk, not forming striae; moderately large and distinct punctures of abdominal ventrites; moderately developed tubercle of ventrite I of male; shallow, finely setose impression on ventrite V of male; and by the structure of the aedeagus.



Figs. 3-5.

Sicoderus ivieorum sp. n. male.
 – 3, legs, a, front. b, middle. c,
 hind; 4, abdomen; 5, aedeagus,
 a, dorsal view, b, lateral view.
 (3-4, scale line = 1.0mm; 5,
 scale line = 0.5mm)

Sicoderus hirsutiventris sp. n.
 (figs. 6-10)

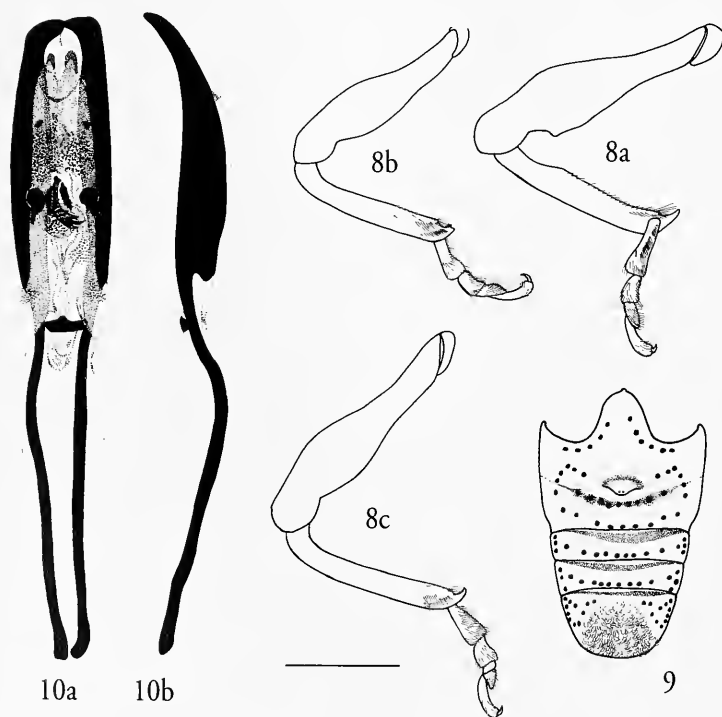
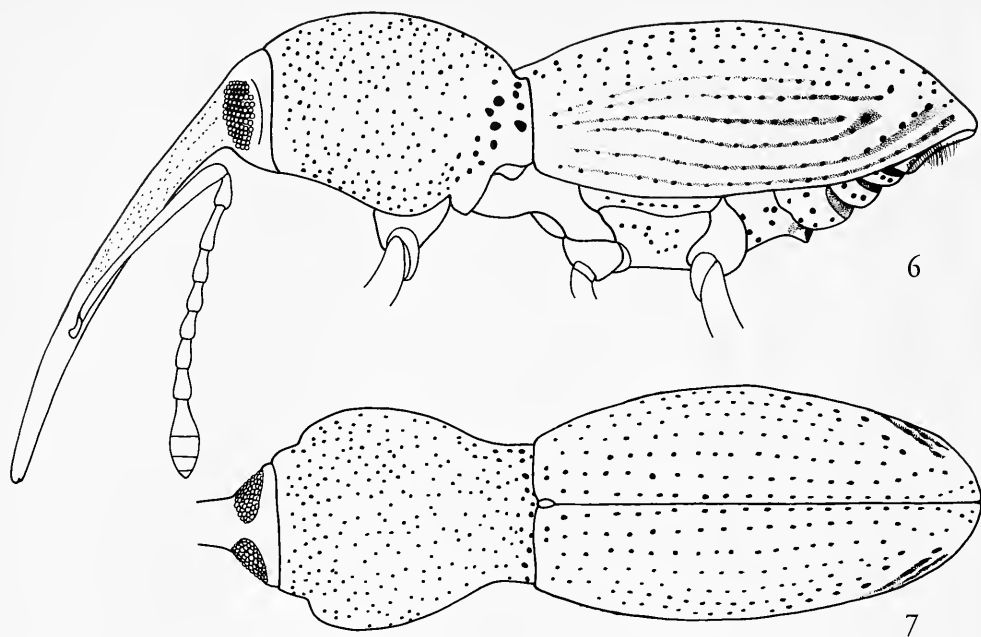
Description

Length male, 4.3-6.5 mm. Integument black, shining. Rostrum $0.80-0.85\times$ length elytra in male. Antennal insertion at apical two-fifths in male. Antenna with article II of funicle $1.29-1.32\times$ length article III in male. Prothorax with length $1.17-1.27\times$ width in male. Prothorax constricted anteriorly, globose, widest at anterior one-third; punctures well-separated, very sparse, very fine and shallow on disk, slightly deeper and larger in anterior one-quarter and slightly deeper on flanks; with scattered, appressed setae along anterior constriction. Elytra with length $1.97-1.98\times$ width in male; in dorsal view distinctly widest at mid-length, lateral margins convergent both anteriorly and posteriorly; humeri fully reduced, not at all angulate; with isolated, erect but short (perhaps abraded or broken), scattered setae; apices conjointly rounded. Strial punctures evident, shallow, moderately fine. Membranous wings present, slightly shorter than ely-

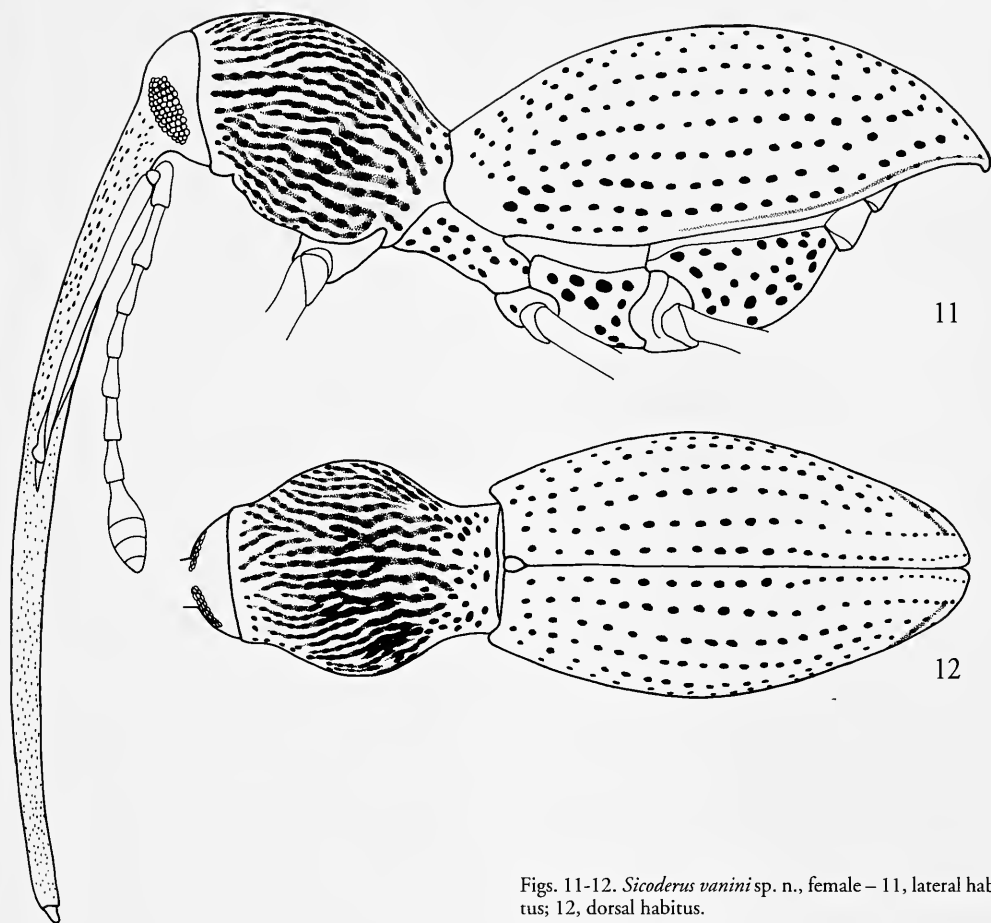
tra in length. Metasternum with punctures indistinct, shallow and irregular; first row of punctures alongside metepisternum consisting of 6 widely spaced, very shallow punctures. Abdominal ventrite I of male raised in middle near apical margin forming a markedly elevated tubercle with two small subcontiguous patches of setosity at tip. Ventrite V of male with large rounded deep, densely setose impression about as large as entire ventrite V. Legs with front femora with small, blunt ventral tooth; middle and hind femora lacking tooth; tarsal claws with small basal tooth. Aedeagus with shallow apical notch; internal sac with complex of denticles and sclerites.

Female not known.

Type material. – Holotype male, labelled: 'st. THOMAS, VIR. IS.,/ Ridge above/ Charlotte Amalie/ July 17, 1979', 'Collector:/ C. W. O'Brien' (cwoB). – Paratype, 1 male: VIRGIN ISLANDS: St. John Est., Gt. Cinnamon Bay, Cinnamon Bay Trail, 17 July 1994, beating, M.S. Becker colr. (1♂, MAIC).



Figs. 6-10.
Sicoderus hirsutiventris sp. n., male – 6, lateral habitus; 7, dorsal habitus; 8, legs, a, front. b, middle. c, hind; 9, abdomen; 10, aedeagus, a, dorsal view, b, lateral view. (8-9, scale line = 1.0 mm; 10, scale line = 0.5 mm).



Figs. 11-12. *Sicoderus vanini* sp. n., female – 11, lateral habitus; 12, dorsal habitus.

Derivation of specific name

This species is named from the Latin 'hirsutus' meaning hairy and 'venter' meaning underside; in reference to the large, setose impression of ventrite V in the male of this species.

Comments

Sicoderus hirsutiventris can be distinguished from other *Sicoderus* in the West Indies by the following combination of character states: presence of a small tooth on only the front femora; elytra with humeri fully reduced and not at all angulate; sparse and fine punctures of the pronotal disk, not forming striae; moderately large and distinct punctures of abdominal ventrites; moderately developed tubercle of ventrite I of male; large, densely setose impression on ventrite V of male; and by the structure of the aedeagus.

Sicoderus vanini sp. n. (figs. 11-13)

Description

Length female, 5.0-6.6 mm. Integument black, shining. Rostrum $1.21-1.48\times$ length elytra in female. Antennal insertion submedial in female. Antenna with article II of funicle $1.22-1.33\times$ length article III in female. Prothorax with length $1.22-1.33\times$ width in female. Prothorax constricted anteriorly, globose, widest at midlength; punctures dense, large and deep, coalescent, forming striae on disk, slightly shallower and smaller in anterior one-fifth and towards posterior margin, slightly deeper and larger on flanks where striae more distinct; erect setae lacking. Elytra with length $1.78-2.00\times$ width in female; in dorsal view widest at about midlength, lateral margins slightly convergent both anteriorly and posteri-

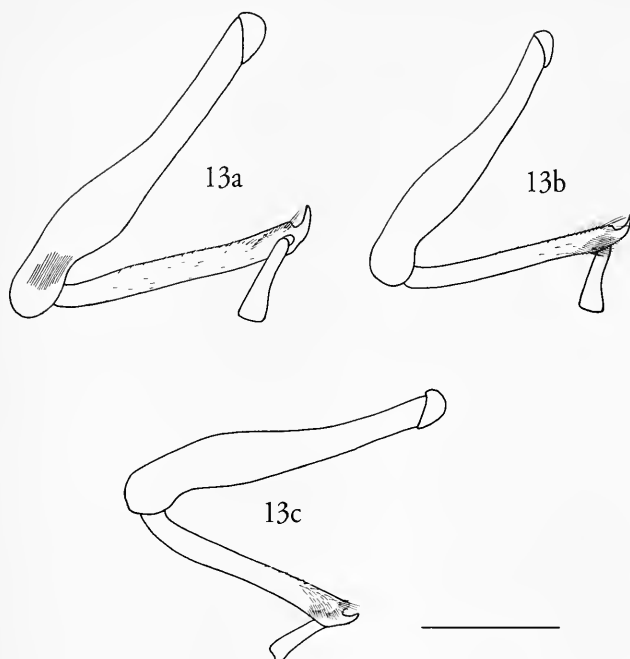


Fig. 13.
Sicoderus vanini sp. n., female – legs, a, front. b, middle. c, hind. (scale line = 1.0 mm).

orly; humeri fully reduced, not at all angulate; lacking erect setae (perhaps abraded or broken); apices conjointly rounded. Strial punctures evident, shallow, moderately fine. Membranous wings lacking. Metasternum with punctures large and deep; first row of punctures alongside metepisternum consisting of 4-5 closely spaced, large deep punctures. Abdominal ventrite I of female markedly convex. Ventrite V of female uniformly slightly convex. Legs with all femora lacking tooth; tarsal claws with small basal tooth.

Male not known.

Type material. – Holotype female, labelled: 'British Virgin Islands/ Tortola, Smuggler's/ Cove 25/ 29.viii.1988/ J.LaSalle coll. (YPT)' (CWOB). – Paratype, 1 female: BRITISH VIRGIN ISLANDS: Tortola, Smuggler's Cove, 25-29 aug 1988, J.LaSalle coll., yellow pan trap (1 ♀, CWOB).

Derivation of specific name

This species is named for Sergio Vanin in honour of his past work on the Erodiscini.

Comments

Sicoderus vanini can be distinguished from other *Sicoderus* in the West Indies by the following combination of character states: lack of femoral teeth; elytra with humeri fully reduced and not at all angulate; dense and deep punctures of the pronotal disk, forming distinct striolae; and large and distinct punctures of the abdominal ventrites.

KEY TO SICODERUS ADULTS IN WEST INDIES (including Florida and Bahamas)

1. Tarsal claws with small basal tooth. Florida, Bahamas, Greater Antilles, Lesser Antilles south to Guadeloupe2
- Tarsal claws simple, lacking basal tooth. Lesser Antilles south of Guadeloupe11*
2. Elytra in lateral view with apex abruptly truncate (see Vanin 1986: Fig. 315). Hispaniola.
.....*S. truncatipennis* Vanin
- Elytra in lateral view with apex uniformly tapered. Florida, Bahamas, Greater Antilles, Lesser Antilles south to Guadeloupe.....3
3. Humeri angulate. Florida, Bahamas, Cuba, Hispaniola.....4
- Humeri rounded, not at all angulate (Figs. 2, 7, 12). Hispaniola, Puerto Rico, Virgin Islands, Guadeloupe7
4. Legs with all femora with distinct (although small on middle and hind legs) tooth on inner margin.5
- Legs with only front femora with distinct (although small) tooth on inner margin6
5. Pronotum on flanks with at least some punctures coalescent, forming lateral striolae. Aedeagus as figured in Vanin 1986; Fig. 317. Dominican Republic.*S. championi* Vanin
- Pronotum on flanks with punctures not coalescent, not forming striolae. Aedeagus as figured in Vanin 1986; Fig. 316. Southern Florida, Bahamas.....*S. tinamus* (LeConte)

6. Elytra usually with a few setae present (see Vanin 1986; Figs. 322-323). Antennal funicle with article II 1.1-1.3 \times length of article III. Aedeagus as figured in Vanin 1986; Fig. 324. Cuba*S. sleeperi* Vanin*
- Elytra lacking setae (see Vanin 1986; Figs. 320-321). Antennal funicle with article II 1.4-1.5 \times length of article III. Aedeagus as figured in Vanin 1986; Fig. 325. Dominican Republic*S. schoenherri* Vanin
7. Ventrites with shallow, small, indistinct punctures; male with tubercle on ventrite I set equidistant between posterior margin of hind coxal cavity and posterior margin of ventrite I. Guadeloupe*S. delauneyi* (Chevrolat)
- Ventrites with at least anterolateral portions of ventrite I and ventrite II along suture with ventrite I with moderately deep, moderately large to large, distinct punctures; male with tubercle on ventrite I set immediately anterior to posterior margin of ventrite I. Hispaniola, Puerto Rico, Virgin Islands8
8. Pronotal disk with punctures large, deep, dense, coalescent and forming striolae; striolae deeper and more distinct on flanks (Figs. 11-12). Female rostrum long (1.21-1.48 \times length elytra) (Fig. 11). British Virgin Islands (Tortola).....*S. vanini* sp. n.
- Pronotal disk with punctures very fine and shallow, widely spaced, not forming striolae (Figs. 1-2, 6-7). Female rostrum shorter (1.11-1.23 \times length elytra; female *S. hirsutiventris* not known). Hispaniola, U.S. Virgin Islands, British Virgin Islands9
9. Pronotum on flanks with punctures moderately large and deep, closely separated, coalescent on some specimens and forming irregular striolae. Hispaniola.....*S. ramosi* (Sleeper)
- Pronotum on flanks with punctures very fine, shallow, widely separated, not coalescent (Figs. 1, 6). U.S. Virgin Islands10
10. Legs with all femora with distinct ventral tooth (Fig. 3); male rostrum longer (0.97-1.00 \times length elytra) (Fig. 1); male with small, shallow, finely setose impression on ventrite V (Fig. 4). U.S. Virgin Islands (St. John), British Virgin Islands (Jost Van Dyke, Tortola).....*S. ivieorum* sp. n.
- Legs with only front femora with small ventral tooth (Fig. 8a); male rostrum shorter (0.80-0.85 \times length elytra) (Fig. 6); male with very large, deep, densely setose impression on ventrite V (Fig. 9). U.S. Virgin Islands (St. John, St. Thomas)*S. hirsutiventris* sp. n.
11. Tubercles of ventrite I in male nearly contiguous (see Vanin 1986; Fig. 302). St. Vincent.*S. contiguous* Vanin*
- Tubercles of ventrite I in male not contiguous (see Vanin 1986; Figs. 300-301) 12
12. Tubercles of ventrite I in male separated by a distance nearly equal to the width of the abdominal process at base (see Vanin 1986; Fig. 300). St. Vincent*S. remotus* Vanin*
- Tubercles of ventrite I in male separated by a distance varying from one-quarter to one-third of the width of the abdominal process at base (see Vanin 1986; Fig. 301). Grenadines, Grenada, Trinidad and Tobago.*S. propinquus* Vanin*

* Species not seen by the author.

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Thanks are due to Michael and Donna Ivie for inviting me to become involved in the Virgin Islands Beetle Project and for lending some of the specimens on which this paper is based. I also thank Charles W. O'Brien for the loan of specimens and for review of the manuscript. Susan Laurie-Bourque prepared the line illustrations. This paper is a contribution to the NSF sponsored Virgin Islands Beetle Project, Michael A. Ivie (Principal Investigator).

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BOOK REVIEW

F. Bos & M. Wasscher, 1997. Veldgids libellen. – Stichting Uitgeverij KNNV, Utrecht. NLG 49.95 p/p excl. Available from KNNV Uitgeverij, Oudegracht 237, 3511 NK Utrecht, The Netherlands. [Field guide to Odonata, In Dutch]

The study of the distribution and status of dragonflies (Odonata) has become very successful among amateur entomologists of western Europe, and the results are equally impressive. Study groups are investigating nearly every kilometre square for dragonflies, resulting in overviews of the distribution of the species on local, regional or national scale. These activities are particularly welcome, since the distribution of many species appears to be highly dynamic at present. The range expansion of species as *Erythromma viridulum*, *Crocothemis erythraea* and *Anax parthenope* during the last twenty years has been carefully documented. On the other hand, also rare and threatened species have been mapped and many formerly unknown populations have been discovered, providing the necessary data for measures to protect biotopes optimal for Odonata.

Of course, the basic data of maps shall be reliable. It is impossible and also undesirable, that such atlases are only based on material in collections. Besides, in many parts of Europe some, and in some countries all species are protected by law, making even the effort to collect them unlawful. These facts are hints for the obvious need for field guides to dragonflies, as there are so many to birds, mammals and butterflies. Various of such guides have been published during the last few years. The concept of some of these guides is highly original. Three authors, Tienieke de Groot, Weia Reinboud and Marcel Wasscher prepared (in Dutch) the 'Odon-key for identification of dragonflies without collecting' (published in 1993 by the Jeugdbondsuitgeverij, Donkerstraat 17, 3511 AR Utrecht), aiming at young amateurs in The Netherlands and Belgium. This simply produced key is based on a profound field knowledge of the species, leading the starting and more advanced odonatist through the identification process in an authoritative way. The illustrations are simple, but adequate. Based on a completely different concept, but equally innovative, is

Steve Brooks' (editor) 'Field guide to the dragonflies and damselflies of Great Britain and Ireland'. All species are represented by several colour illustrations. The texts are well-structured, with descriptions divided into paragraphs on jizz, field characters and similar species.

The 'Veldgids libellen' (Field guide to Odonata) by Frank Bos and Marcel Wasscher is a more conventional, but attractively produced guide to the species of western, northern and central Europe. More than 160 colour photographs are included. The common species are represented by both adult male and female, the less common only by male or female. Pages opposite to photos have texts on recognition, flight period, habitat, range and distribution, including small distribution maps for Europe, and an indication in colour of how common a species is in The Netherlands. Apart from the scientific name, also the Dutch, English, German, French and Swedish names are provided. Also, there are the usual introductory chapters on morphology, life cycle and habitats.

The quality of most colour illustrations is satisfactory, but really good photographs are scarce. The texts, although obviously written by experts, suffer somewhat from a lack in format. Beginners will meet difficulties in finding the correct name for a specimen, particularly so, since an identification key is missing. Illustrations of structural details are given in some cases only, e.g. dorsal views of the prothorax of *Coenagrion* species.

The first edition included several errors, which were corrected in the second edition of December 1998. The main addition is the inclusion of the Red Data Lists of The Netherlands and Flanders (Belgium). The printing of some photographs has been improved, and some photographs have been replaced by better ones. The best news of this reprint is that more than 4000 copies of a colour guide to the dragonflies written in Dutch were sold in less than one year, indicating how popular the study of dragonflies nowadays is.

[J. van Tol]

A TAXONOMIC REVISION OF THE ORIENTAL WATER STRIDER GENUS *VENTIDIUS* DISTANT (HEMIPTERA, GERROMORPHA, GERRIDAE)

Chen, P. P. & H. Zettel, 1999. A taxonomic revision of the oriental water strider genus *Ventidius* Distant (Hemiptera, Gerromorpha, Gerridae). – Tijdschrift voor Entomologie 141 [1998]: 137-208, figs. 1-266, maps 1-6, tables 1-3. [ISSN 0040-7496]. Published 1 March 1999.

The Oriental water strider genus *Ventidius* Distant is redescribed and revised. The morphological characters of *Ventidiopsis* Miyamoto and *Esakia* Lundblad and their relationships with *Ventidius* are discussed. *Ventidiopsis* Miyamoto is ranked as a subgenus of *Ventidius* (stat. n.). Six species are described as new: *Ventidius* (s. str.) *longitarsus* sp. n. from Viet Nam, *V.* (s. str.) *piilosus* sp. n. from Indonesia (Nusa Tenggara Timur, Nusa Tenggara Barat), *V.* (s. str.) *polhemorum* sp. n. from Malaysia (Sabah, Sarawak), *V.* (*Ventidioides*) *heissi* sp. n. from Malaysia (Sarawak), *V.* (*Ventidioides*) *nieseri* sp. n. from Brunei, Malaysia (Sarawak) and Indonesia (Kali-mantan), and *V.* (*Ventidiopsis*) *yangae* sp. n. from Malaysia (Sabah). The following species are redescribed: *Ventidius* (s. str.) *aquarius* Distant, *V.* (s. str.) *usingeri* Hungerford & Matsuda, *V.* (s. str.) *harrisoni* Cheng, *V.* (s. str.) *malayensis* Hungerford & Matsuda, *V.* (s. str.) *henryi* Esaki, *V.* (s. str.) *hungerfordi* Cheng, *V.* (s. str.) *werneri* Hungerford & Matsuda, *V.* (s. str.) *modulatus* Lundblad, *V.* (*Ventidioides*) *kuiterti* Hungerford & Matsuda, *V.* (*Ventidioides*) *karen* Lansbury, *V.* (*Ventidioides*) *pulai* Cheng, *V.* (*Ventidioides*) *lundbladi* Miyamoto, *V.* (*Ventidioides*) *xiphibion* Chen & Nieser, *V.* (*Ventidioides*) *xyele* Chen & Nieser, *V.* (*Ventidioides*) *kurtokalami* Chen & Nieser, and *V.* (*Ventidiopsis*) *imadatei* Miyamoto. Type specimens of most species were re-examined, except those of *V.* (s. str.) *distanti* Paiva, *V.* (s. str.) *sushmae* Gupta, and *V.* *lundbladi*, which were unavailable. The following taxa are considered as synonyms (junior synonyms in brackets): *Ventidius* (s. str.) *hungerfordi* Cheng (= *Ventidius wallacei* Lansbury, syn. n.), *V.* (s. str.) *modulatus* Lundblad (= *V. pubescens* Cheng, syn. n., = *V. chinai* Hungerford & Matsuda, syn. n.). *V. sushmae* Gupta is regarded as a nomen inquirendum. One new combination is established: *Ventidius* (*Ventidiopsis*) *imadatei* Miyamoto, comb. n. The identity of *V. distanti* is discussed. A lectotype of *V. modulatus* Lundblad is designated.

The species are arranged in three subgenera and five species groups: *Ventidius* (s. str.): *V. aquarius*-group, *V. modulatus*-group; *Ventidius* (*Ventidioides*): *V. kuiterti*-group, *V. xiphibion*-group; *Ventidius* (*Ventidiopsis*): *V. imadatei*-group. Descriptive notes and illustrations of pertinent characters are presented for all species. Tables of measurements and an identification key for apterous males of all described species are presented.

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Key words. – Gerridae; *Ventidius*; revision; new species; distribution; identification key; Oriental region.

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INTRODUCTION

This revision deals with the species of the Oriental water strider genus *Ventidius* Distant, 1910, which was last revised by Hungerford & Matsuda (1960). *Ventidius* was established by Distant for a Halobatine Gerrid from 'Travancore, India', which he named *Ventidius aquarius* (Distant 1910a: 150). In the same year, Distant (1910b: 157) figured both macropterous and apterous specimens of the same species.

Bergroth (1911) considered *Ventidius* a synonym of *Metrocoris* Mayr, which was corrected by Esaki (1929). Paiva (1918) described *V. distantii* from 'Yawnghwe State' (today belonging to Myanmar), a species which was misinterpreted several times by the following authors: Dover (1929), Esaki (1930), Hungerford & Matsuda (1960). Esaki (1928) and Lundblad (1933) described two further species, *V. henryi* Esaki from Sri Lanka and *V. modulatus* Lundblad from Java.

Hungerford & Matsuda (1960) revised the genus, recognizing nine species, including five new species from Myanmar (Burma), Malaysia, and the Philippines. Beside giving excellent pictures of the dorsal view of all the nine species, they also presented figures for characters of the new species (*V. malayensis*, *V. usingeri*, *V. werneri*, *V. chinai*, and *V. kuiterti*). They also divided the genus into two subgenera: *Ventidius* (s. str.) and *Ventidioides* Hungerford & Matsuda, 1960 (type species: *V. kuiterti*) according to four characters: shape of posterolateral angle of metacetaula bilobate or transverse; fore femur with or without a tubercle; mesosternum with or without a tubercle; and parameres large or small and asymmetrical or symmetrical. Matsuda (1960) gave an extensive morphological description for the genus and set it close to the Madagascan genus *Eurymetropsielloides* Poisson 1956, and the Oriental genus *Esakia* Lundblad 1933, and within the newly established tribe Metrocorini Matsuda 1960. Cheng (1965) reviewed the *Ventidius* species of Malaysia and Singapore and described four species as new from this area: *Ventidius pulai*, *V. harrisoni*, *V. hungerfordi*, and *V. pubescens*.

Since that time, only smaller notes on *Ventidius* and sporadic descriptions of new species have appeared. Miyamoto (1967) added *V. lundbladi* as a new species from Thailand, and *Ventidius sushmae* was described by Gupta (1981) from India (here regarded as a nomen inquirendum). Andersen (1982) figured the distribution of Metrocorini, indicating that its range in the Malay archipelago is limited by the Wallace's Line. Later on, several species of *Ventidius* and *Metrocoris* were described from Sulawesi. Lansbury (1990) described *V. (Ventidioides) karen* from Thailand, and *V. (s. str.) wallacei* from Malaysia, the latter a synonym of *V. hungerfordi* (syn. n.). Three new species of the sub-

genus *Ventidioides*, *V. kurtokalami* (from Sabah), *V. xiphobion*, and *V. xyele* (both from Sulawesi), were described by Chen & Nieser (1992), increasing the number of species to 20. Kovac & Yang (1989) and Yang & Kovac (1995) reported new records of *V. malayensis*, *V. harrisoni*, *V. hungerfordi*, *V. pulai* and *V. modulatus* from the Malaysian Provinces of Pahang and Perak, respectively. Finally, Thirumalai (1996) reported *V. (Ventidioides) kuiterti* as a new record from NE India.

The genus *Ventidiopsis* was erected by Miyamoto (1967) for the single species *Ventidiopsis imadatei* Miyamoto 1967, from Borneo. Because of close relationship between *Ventidiopsis* and *Ventidioides*, both taxa are regarded as subgenera of *Ventidius* in the present study.

Since the genus *Esakia*, which here is regarded as the genus most closely related to *Ventidius*, was described by Lundblad (1933), six species were described from Myanmar (Burma), Malaysia, Borneo (Brunei), and the Philippines (Luzon) (Cheng 1966, Hungerford & Matsuda 1958, Miyamoto 1967). Further new species are known to the authors from Viet Nam, Borneo, and the Philippines (Palawan). In the present study, *Esakia ventidioides* Lundblad 1933, from Sumatra (Lundblad 1933) was checked.

The Madagascan genus *Eurymetropsielloides*, which is according to Matsuda (1960) the sister taxon of *Ventidius*+*Esakia*, differs from both of these genera by the metacetaula having strongly downcurved posterolateral corners (plesiomorphic character) and an unusual colour pattern (apomorphic character) (see also Matsuda 1960).

In the present taxonomic revision we recognize 24 species of *Ventidius*, including six new species described from Viet Nam, Borneo and Indonesia (Sumba, Sumbawa). They are arranged in three subgenera and five species-groups (see following check-list).

Ventidius species are small, black and green (turns to yellowish after death) water striders which are typical inhabitants of slow-flowing forest streams in South and Southeast Asia. Their preferred habitats are as far as we know for a few species-lotic areas of brooks, streams and rivers, where they stroke and glide across the surface. Because of their preference for the slow-flowing streamlets, *Ventidius* are mainly encountered in hilly and lowland areas. The life history of *Ventidius* species is unknown. Murphy (1990) described the habitat in Singapore of *V. (s. str.) hungerfordi* Cheng as follows: 'The outflow stream of the Nee Soon swamp forest is small but fairly recent alluvia, and is deeply shaded. Here the open water is populated by *Ventidius harrisoni* and *Rheumatogonus intermedius*, sandbanks by *Amemboa riparia* and *Tenagomonus quiquemaculata* and under the overhanging root mats the tiny haloveliinae *Strongilovelina* occurs. [...] Farther upstream a network of shallow channels on peat but

still with moving water is populated by *Metrocoris tenuicornis*, stiller water with leaf beds by *Tenagoponius insularis*. Throughout the whole system, leafy banks carry large numbers of *Rhagovelia femorata*. Elsewhere in the swamp forest of Nee Soon are larger but now inaccessible rivers where *Ventidius hungerfordi*, *Esakia fernandoi* and *Cylindrostethus costalis* were collected.'

Notes on relationships

In this paragraph, relationships between the taxa *Ventidius*, *Ventidioides*, *Ventidiopsis* and *Esakia* are discussed.

The subgenus *Ventidius* s. str. consists of two rather different species-groups of closely related species which are both widely distributed in the Oriental region. Although both of these groups are clearly defined by several apomorphic characters, the only synapomorphy of both groups may be the reduction of paramere size. It is not proved, if the subgenus *Ventidius* s. str. is a monophyletic taxon or a paraphyletic group at the base of the genus *Ventidius*. In the latter case, the species of the *V. aquarius*-group belong to *Ventidius* s. str., and the *V. modulatus*-group should be raised to a presently unnamed subgenus.

Ventidioides forms a rather nonhomogeneous accumulation of species which are divided here into two established species-groups; all characters discussed by Hungerford & Matsuda (1960), Matsuda (1960), Cheng (1965), and Lansbury (1990) refer to species of the *V. kuiterti*-group, which inhabits the Southeast Asian mainland. The *V. xiphibion*-group contains five species from Borneo and Sulawesi. The only synapomorphy for all *Ventidioides* species is the presence of special structures on mesosternum of males (tubercle with setae or row of setae). All other 'apomorphic' characters mentioned by Hungerford & Matsuda (1960) and Matsuda (1960) are either not developed in all species (tubercle of fore femur lacking in the *V. xiphibion*-group) or are also developed in *Ventidiopsis*. If *Ventidioides* proves to be polyphyletic, then the *V. xiphibion*-group should be raised to a presently unnamed subgenus.

When Miyamoto (1967) described *Ventidiopsis imadatei*, only the female was known, which has striking characters, and therefore this species was placed in a new genus different from *Ventidius*. After studying the male of *V. imadatei*, we found some reasons to include *Ventidiopsis* as a subgenus within *Ventidius* and to treat it within this revision. At least two striking characters are regarded as synapomorphies of the subgenera *Ventidioides* and *Ventidiopsis* stat. n., i.e. the bilobate posterolateral angle of metacetabula and the asymmetrical parameres.

The species of *Esakia* form a homogeneous group with several synapomorphic characters, e.g. the dilat-

ed third antennal segment of male, the reduced fore wing venation, and a flatter, anteriorly more widened body (see also Matsuda [1960]). But the complete absence of an anterolateral separation of the metanotum (which is present in *Esakia* by a longitudinal elevation) is the only character which we found useful as synapomorphy of the proposed monophylum *Ventidius*+ [*Ventidioides*+ *Ventidiopsis*].

The monophyletic status of *Ventidius*+*Esakia* is supported by several characters, e.g. short pronotum, larger eyes, and rather strongly flattened metacetabula (Matsuda 1960), which is confirmed by this study. This provisional arrangement of genera and subgenera should be proven in a subsequent cladistic analysis.

An analysis of the present distribution of *Ventidius* suggests that Malaysia has the richest biodiversity.

Checklist

Ventidius Distant 1910

Subgenus *Ventidius* s. str.

Ventidius aquarius-group

1. *aquarius* Distant 1910
2. *usingeri* Hungerford & Matsuda, 1960
3. *harrisoni* Cheng, 1965
4. *malayensis* Hungerford & Matsuda, 1960
5. *longitarsus* sp. n.

Ventidius modulatus-group

6. *henryi* Esaki, 1928
7. *hungerfordi* Cheng, 1965
- = *wallacei* Lansbury, 1990
8. *werneri* Hungerford & Matsuda, 1960
9. *polhemorum* sp. n.
10. *pilosus* sp. n.
11. *modulatus* Lundblad, 1933
- = *chinai* Hungerford & Matsuda, 1960
- = *pubescens* Cheng, 1965
12. ? *distanti* Paiva, 1918
13. ? *sushmae* Gupta, 1981

Subgenus *Ventidioides* Hungerford & Matsuda, 1960

Ventidius kuiterti-group

14. *kuiterti* Hungerford & Matsuda, 1960
15. *karen* Lansbury, 1990
16. *pulai* Cheng, 1965
17. *lundbladi* Miyamoto, 1967

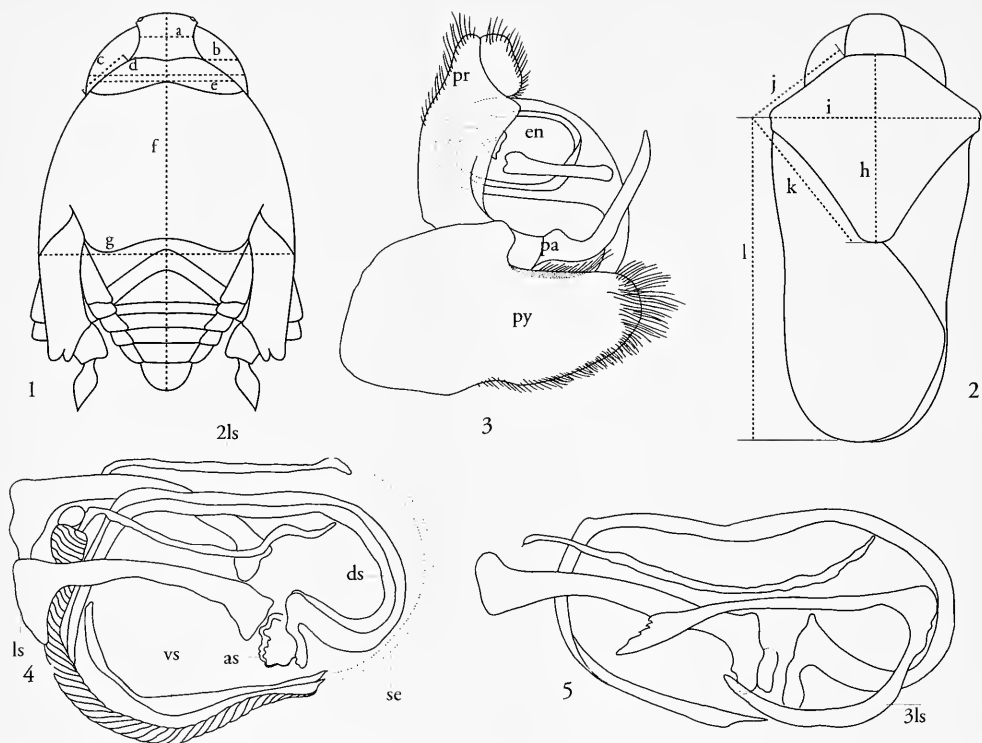
Ventidius xiphibion-group

18. *xiphibion* Chen & Nieser, 1992
19. *xyele* Chen & Nieser, 1992
20. *kurtokalami* Chen & Nieser, 1992
21. *nieseri* sp. n.
22. *heissi* sp. n.

Subgenus *Ventidiopsis* Miyamoto, 1967

Ventidius imadatei-group

23. *imadatei* Miyamoto, 1967
24. *yangae* sp. n.



Figs. 1-5. Diagrams of *Ventidius* sp. with lines indicating measurements. – 1, apterous male (appendages removed) in dorsal view (a, interocular width; b, eye width; c, posterior eye width; d, head width; e, pronotum width; f, median length of body; g, body width across acetabula); 2, macropterous form (appendages removed) in dorsal view (h, median length of pronotum; i, humeral width of pronotum; j, length of lateral margin from anterior angle to humerus of pronotum; k, length of lateral margin from humerus to apex of pronotum; l, length of fore wing from humerus to apex); 3, lateral view of genital segments (py, pygophore; pr, proctiger; pa, paramere; en, endosoma); 4, dorsolateral view of endosoma (as, apical sclerites; ds, dorsal sclerites; ls, lateral sclerites; 2ls, second lateral sclerites; se, ductus seminis; vs, ventral sclerites); 5, lateral view of endosoma (3ls, third lateral sclerites).

MATERIAL AND METHODS

The revision is chiefly based on material borrowed from various museums and private collections (listed as depositories below). Parts of the material were recently collected by the authors in Eastern Malaysia, Thailand, and the Philippines. The holotypes of all new species are deposited in major institutions and museums as indicated in the taxonomic section.

Olympia optics, including a Camera Lucida, were used in studying and drawing the specimens. Examination of the male terminalia is essential for a safe identification of most species of *Ventidius*. The male genital segments were detached from the specimens. Before dissection, the segments were cleared in 10% potassium hydroxide for 12-24 hours at room temperature, or till the endosoma became clearly visible. For studies of thoracic hair layers in species of the *V. modulatus*-group a Wild binocular optic with magni-

fication up to 1000× was used.

All measurements in the descriptions are in millimetres. The tables of measurements (table 1-3) give the means of measurements of six specimens for each species or, if less than six specimens were available, of all specimens studied. Interocular width is the shortest distance between eyes (fig. 2, a); eye width is the greatest width of the eye measured perpendicular to the longitudinal axis of the head (fig. 2, b); head width is the greatest width of head measured across eyes (fig. 2, d). Width of pronotum in the apterous form and pronotal measurements in the macropterous form as illustrated in figs. 1 and 2, respectively. When measuring the antennal segments, the small internodal piece between segments 2 and 3 was included into the length of segment 3. Terms of male genitalia see figs. 4-5.

List of depositories

AMNH	American Museum of Natural History, New York, U.S.A.
BIMC	B.P. Bishop Museum, Honolulu, U.S.A.
BMNH	The Natural History Museum, London, U.K. (= former British Museum [Natural History]).
CNHM	Chicago Natural History Museum, Chicago, U.S.A.
FMHF	Finnish Museum of Natural History, Helsinki, Finland.
FMNH	Field Museum of Natural History, Chicago, U.S.A.
GCLB	Gupta Collection, Los Banos, Philippines.
JTPC	Colorado Entomological Museum, Englewood, Colorado, U.S.A. (= formerly J. T. Polhemus Collection).
KKUA	Khon Kaen University, Faculty of Agriculture, Department of Entomology, Khon Kaen, Thailand.
NCTN	Nieser Collection, Tiel, The Netherlands.
NHMW	Naturhistorisches Museum Wien, Vienna, Austria.
OUMC	Hope Department, Oxford University Museum, Oxford, U.K.
PPCC	P. P. Chen Collection, Beijing, China.
RMNH	Nationaal Natuurhistorisch Museum Naturalis (formerly Rijksmuseum van Natuurlijke Historie), Leiden, The Netherlands.
SCCU	W. D. Shepard Collection, California State University, Sacramento, U.S.A.
SEMC	Francis Huntington Snow Entomological Museum, University of Kansas, Lawrence, Kansas, U.S.A.
SMNH	Swedish Museum of Natural History, Stockholm, Sweden.
SPCM	Sabah Parks Collection, Kota Kinabalu, Malaysia.
TMBC	Magyar Természettudományi Museum (= Hungarian Natural Science Museum), Budapest, Hungary.
UMSM	Universiti Malaysia Sabah, Kota Kinabalu, Malaysia.
UPLB	University of the Philippines, Los Banos, Natural History Museum, Philippines.
ZCMG	G. Zimmermann Collection, Marburg, Germany.
ZCWA	H. Zettel Collection, Vienna, Austria.
ZMAC	Instituut voor Systematiek en Populatiebiologie (= formerly Zoologisch Museum), University van Amsterdam, Amsterdam, The Netherlands.
ZMUC	Zoological Museum, University of Copenhagen, Copenhagen, Denmark.
ZRCS	Zoological Reference Collection, Singapore.

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TAXONOMY

Genus *Ventidius* Distant

Ventidius Distant, 1910: 149-150. Type-species by monotypy: *Ventidius aquarius* Distant, 1910.

Ventidius Distant; Bergroth 1911: 186 (synonymized *Ventidius* with *Metrocoris* Mayr); Esaki 1928: 509-511 (descr., new species); Esaki, 1929: 417 (confirmed as valid genus); Esaki 1930: 18; Hungerford & Matsuda 1960: 323-343 (descr., illustr., key, new species, new subgenus); Matsuda 1960: 313-316 (morphological descr., syst., illustr.); Cheng 1965: 153-163 (key to species of Malay Peninsula, descr., illustr., new species); Gupta 1981: 97-99 (descr., illustr., key to subgenera, new species); Kovac & Yang 1989: 285 (list, in Pahang, Malaysia); Chen & Nieser 1992: 156-159 (descr., illustr., new species); Yang & Kovac 1995: 293 (list, Perak, Malaysia); Zettel & Chen 1996: 152, 180 (list, Viet Nam).

Nomenclatorial notes. – The genus *Ventidius* was established by Distant (1910) for the new species *V. aquarius*, known from both apterous and macropter-

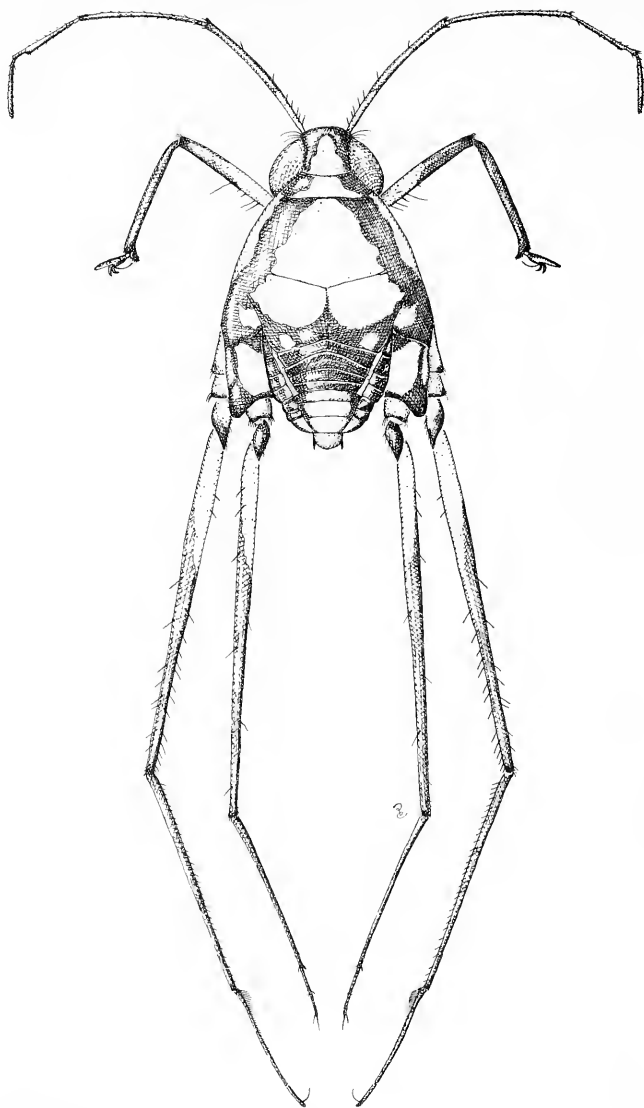


Fig. 6. *Ventidius* (s. str.) *usingeri*, apterous male, length 3.65 mm.

ous forms. Bergroth (1911) considered the genus *Ventidius* Distant identical with *Metrocoris* Mayr, stating that the distinguishing characters given by Distant (1910) were only specific characters, and that therefore, *Ventidius* could not be generally separated from *Metrocoris*. Esaki (1929) pointed out that *Ventidius* was wrongly synonymized by Bergroth (1911), and insisted that *Ventidius* is a very distinct genus. Since then, no more confusion has been created on the generic status, which has been accepted by all recent authors.

Redescription

Dimensions. – Males smaller than females, length of body usually 2.37-4.60 (♂), 2.50-4.40 (♀); maximal width of body usually 1.60-3.10 (♂); 1.74-2.96 (♀); width of head across eyes 1.01-1.65 (♂), 1.04-1.61 (♀).

Colour. – General colouration yellowish to light brown, overlain with complex black patterning. Several small brownish marks or one big dark mark present on interocular space of head, in some species too vague to see. Inner margin of eyes usually with brownish

stripes. Eyes varying from greyish to black. Base of rostrum dark. Antennae dark except basal part of first segment; in two species segments 3 and 4 with yellowish bands. Anteclypeus, labrum and apical part of labium dark. Pronotum of apterous form with lateral dark stripes or a T-shaped dark mark, in some species totally dark. Pronotum of macropterous form mainly dark with two yellowish marks (fig. 9). Mesonotum with lateral dark stripes, but showing broad variation, often forming a pale triangular area between the pale stripes (fig. 6). Metanotum either totally pale or with lateral dark marks or stripes, posterior margin with a triangular dark mark, which is confluent with dark abdominal tergite 1. In some species the pale marks on metanotum confluent with the pale marks on mesonotum and together forming a big mushroom-shaped or pear-shaped pale mark (figs. 54, 183). Propleura yellowish, in some species with a dark mark; a dark stripe usually running through the length of mesopleura; metacetabula yellowish, usually dark at protruding posterior angle, in some species more darkened and with a long yellowish mark in the central part. Narrow dark mark on anterior half of ventral metacetabula. Fore femur yellowish to light at basal third or half; fore tibia either totally dark or pale at base of external surface; fore tarsi totally dark. Middle and hind legs totally dark, in some species the middle legs yellowish basally. Fore wings dark brown with dark veins (fig. 155). Abdomen mainly dark dorsally, with pale marks. Ventral surface of body yellowish.

Structural characters. – Body triangular or subtriangular in dorsal outline, only moderately dorso-ventrally flattened; body clothed with short fine pubescence. Head bluntly projecting anteriorly of eyes, with broadly rounded anterior margin; head length in apterous form about 1.5 times as long as pronotum along median line. Eyes relatively large, narrower than the width of interoculus; posterior margin in lateral view covering propleura and anterior part of mesopleura. Vertex along inner margin of eyes bearing 5-6 stiff setae, interocular with 4 pairs of trichobothria at vertex, the third pair shorter than the other pairs and extending externally, the others pointing upwards (fig. 134). Antennae slender, in males usually stouter than in females; inner surface of antennae usually with fine erect pubescence through apical half of segment 1 to segment (3 or) 4 (except in *V. aquarius*-group with very long antennae in males, longer setae on internal surface and segment 3 of males modified by an apical indentation). Anterior margin of pronotum in apterous form slightly sinuated or concave, posterior margin sinuated. Pronotum of macropterous form large, forming an acute posterior-medial angle. Lateral suture of metanotum not reaching the meso-metanotal suture anteriorly. Pleura clothed with fine pubescence, which in some

species is longer and more conspicuous. Mesosternal 'groove' conspicuous, in most species represented by a translucent internal ridge. Centre of mesosternum in some species with a tuft of tiny bristles, which in certain cases extends towards the anterior margin of the mesosternum. Metasternum reduced to a small triangular sclerite, in some species swollen to a tubercle. Abdomen with some golden pubescence dorsally; caudal margin of posterior abdominal tergites and genital segments with longer pilosity in male. Male abdominal sternite 7 much longer than sternite 6, broadly concave on apical margin. Female abdominal sternite 7 strongly developed and not modified distinctively. Laterotergites usually broad. Legs slender, usually not modified. Fore femur of males slightly stronger than in females, its ventral surface usually smooth, but modified in subgenus *Ventidioides*: in *V. kuiterti*-group with a tooth halfway along its inner surface length (figs. 148-154); in *V. xiphobion*-group sometimes with a broad tubercle (figs. 198-202); fore femur usually bearing a number of long setae, its inner surface sometimes with dense short dark hair fringe. Inner surface of fore tibia in both sexes straight, but in two species (*V. kurtokalami* and *V. nieseri*) with an indentation at 2/5 of its length in male, the remaining 3/5 with distinct dark hair fringe; its apical finger-like projection with a grasping comb in male, which is composed by varied number of bristles and dense pilosity. Inner surface of tarsi with a row of modified hairs, which vary according to species. Middle and hind legs long, middle femur usually slightly shorter than hind femur; middle and hind femora with a number of long spines, and on dorsal surface with one or two long trichobothria-like setae basally.

Male genital segments usually relatively large. They comprise the following structures: the cylindrical segment 8 (s8); the boat-shaped pygophore (fig. 3, py, segment 9); the plate-shaped proctiger (pr, segment 10+11); the parameres (pa), which are varied in size, symmetrical and small in subgenus *Ventidius*, but asymmetrical and longer in subgenus *Ventidioides*, and of high diagnostic importance; and the phallus (ph). The distal section of the phallus is the endosoma, which is armed with a number of sclerites. In the descriptions, the endosoma sclerites and other structures are named as follows (figs. 4, 5): dorsal sclerites (ds), apical accessory sclerites (as), lateral sclerites (ls, paired), ventral sclerites (vs, paired); a second pair of lateral sclerites occurs in all species, a third pair in some species (lp); the ductus seminis (se) is supported by the ventral sclerites.

In females so far only a few useful diagnostic characters have been found, which are usually found also in males (e.g. some group characters, colour pattern, body shape, pilosity). There are no distinct differ-

ences in female terminalia, except in the subgenus *Ventidiopsis*. Within species groups not all females can be identified to species level.

Comparative notes. – *Ventidius* seems to be most closely related to the genus *Esakia*. Main differences are: thorax anteriorly widened and conspicuously flat in *Esakia*, but anteriorly constricted and (usually) domed in *Ventidius*; antennal segment 3 dilated in males of *Esakia*, but usually rounded in *Ventidius* (slightly flattened in subgenus *Ventidiopsis*); in *Esakia* fore wing venation reduced, with closed cells in basal half only, but more developed in *Ventidius*, with closed cells reaching distal half; metanotum with an antero-lateral separation represented by a longitudinal ridge in *Esakia*, but fused with metapleura in *Ventidius*.

Distribution (maps 1-6). – Endemic to the Oriental region, from Sri Lanka to the Philippines and Indonesia (eastward to Sulawesi and Sumba).

Key to the subgenera of *Ventidius*

1. Posterolateral angle of metacetabula truncate or slightly bilobate in caudal view (figs. 29-38, 75-87), parameres symmetrical, pronotum yellow with dark lateral stripes and/or triangular dark mark in middle of hind margin (except: black in *V. henryi*) *Ventidius* s. str.
- Posterolateral angle of metacetabula distinctly bilobate in dorsal view (figs. 157-166, 203-212), parameres asymmetrical, pronotum usually black 2
2. Tergites 3 and 4 fused in apterous morphs; ♀ (apterous): metacetabula and metacoxae each with a stout, medially directed and hairy process (figs. 240-242), metanotum and anterior tergites concave, meso-metanotal suture with or without two tufts of hairs; ♂: antenna very stout, segment 1 thicker than fore tibia, segments 2 and 3 slightly flattened (figs. 249, 252) ... *Ventidiopsis*
- Tergites 3 and 4 not fused; ♀: without medially directed processes on metacetabula and metacoxae, metanotum and anterior tergites slightly convex to flat, rarely slightly concave (in *V. nieseri* sp. n.), meso-metanotal suture without tufts of hairs; ♂: antenna slender, segment 1 thinner than fore tibia, segments 2 and 3 not flattened (fig. 142, 143, 145, 147) *Ventidioides*

Subgenus *Ventidius* (s. str.) Distant, 1910

Diagnosis. – Colouration comparatively lighter than in the subgenus *Ventidioides* (except in *V. henryi*). Antennal segment 1 distinctly shorter than segments 2-4 together. In some species the subdistal part of segment 3 modified. Posterolateral angle of metacetabula not bilobate or only slightly bilobate. Ventral

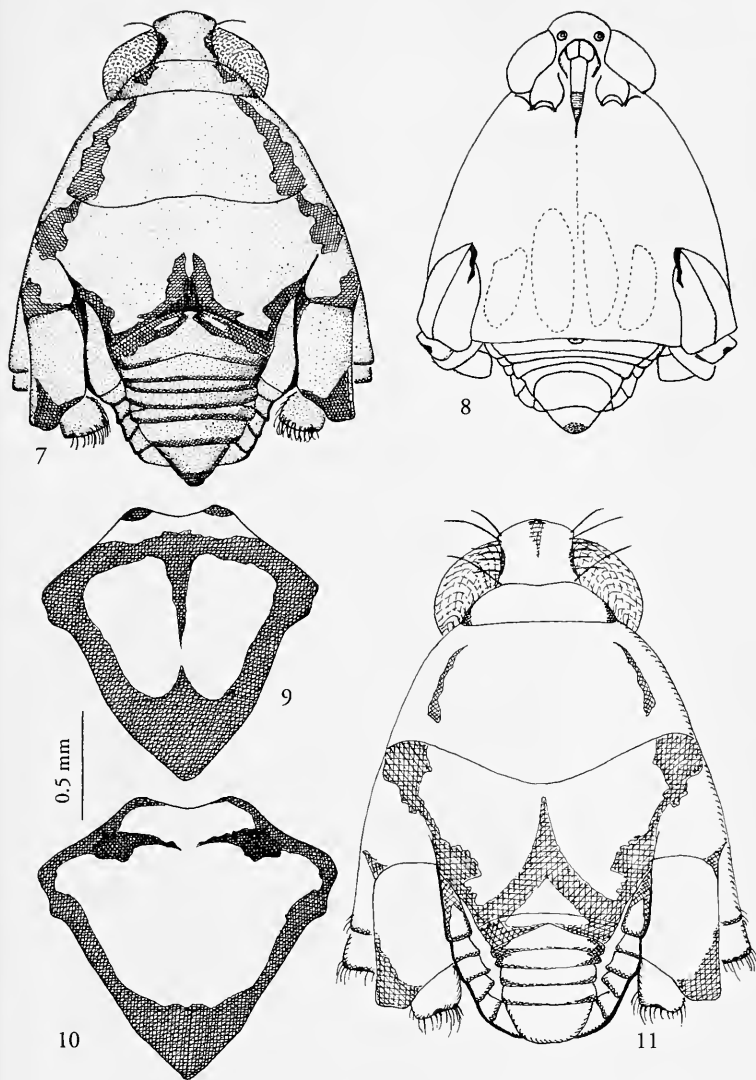
surface of male fore femur not modified without a tooth or tubercle. Mesosternum without tubercle or row of setae. Parameres symmetrical, small.

Distribution (maps 1-3). – Widely distributed throughout the Oriental region, from Sri Lanka to the Philippines, Borneo and Sumba. Highest species diversity in Malaya.

Identifications. – Nearly all characters used in the following key for apterous males are also present in macropterous males (which are unknown in some species) except pronotum not completely black in macropterous *V. henryi*. Females are very difficult to identify, but species-groups can be easily separated by the legs. The middle and hind femora are very stout in females (and males) of the species of *V. aquarius*-group, but comparatively slender in species of the *V. modularis*-group. As species of the *V. aquarius*-group are mostly allopatric, females may be provisionally identified after their provenance; only *V. malayensis* and *V. harrisoni* are known to occur in the same areas, but females of these species can be separated by the length of the fore tarsus (table 1). Furthermore, there may be an overlapping zone between the ranges of *V. malayensis* and *V. longitarsus* sp. n. As we could not find reliable characters to differentiate between females of these species, identifications of single females from Indochina are doubtful. Females of the *V. modularis*-group are indistinguishable, except *V. henryi* with the typical black pronotum, and *V. hungerfordi* with a much flatter body than in *V. modularis*. *Ventidius modularis* is also distinguishable by the shorter pilosity of the mesopleura, but this character is difficult to observe and variable. Other species are allopatrically distributed, but because of the occurrence of *V. modularis* in Borneo, females of *V. polhemorum* sp. n. or *V. modularis* from this island can only be identified by the slightly longer pilosity of the first species.

Key to apterous males of the subgenus *Ventidius*

1. Antennal segments very long and slender; length of segment 1 shorter or subequal to segments 2 and 3 together, usually more than 1.2 mm, at least with 8 long setae which are evenly scattered all over its length; segments 2 and 3 with erect, rather long dark hairs; segment 3 with more or less distinct subapical indentation (figs. 18-22); middle and hind femora very stout (fig. 6, 53); segment 8 with conspicuous deep ventral emargination and lateral tufts of black bristles caudoventrally (figs. 39-42); parameres very small, straight or cucumber-shaped (figs. 43-47) (*V. aquarius*-group) 2
- Antennal segments shorter and less slender; length of segment 1 longer or subequal to segments 2 and 3 together, usually less than 1.2 mm, and usually



Figs. 7-9.

Ventidius aquarius (female, antennae and legs removed, length 3.60 mm). — 7, dorsal view (holotype); 8, ventral view (holotype, egg shells visible); 9, pronotum of macropterous form.

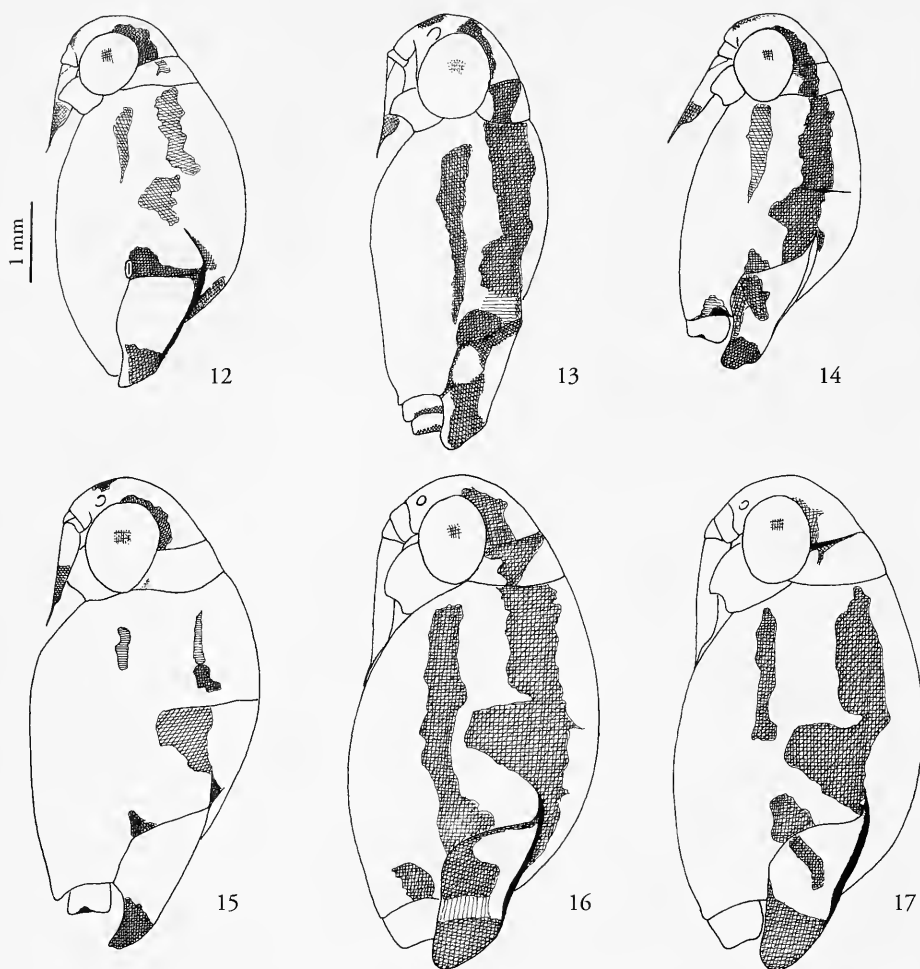
Figs. 10-11.

Ventidius malayensis (male, antennae and legs removed, length XX mm). — 10, pronotum of macropterous form; 11, dorsal view of apterous male.

- with less than 8 setae, most of them in a subbasal row; segments 2 and 3 with dense erect silvery pilosity; segment 3 without subapical indentation (figs. 60-66); middle and hind femora normal, slender (fig. 123); segment 8 without distinct ventral emargination and without lateral tufts of black bristles; parameres slightly longer, in most species apically widened (figs. 97-101), except in *V. henryi* (see fig. 96) (*V. modularis*-group)6
2. Segment 2 of fore tarsus only moderately long, surpassing the claws only slightly, fore tibia internally with a row of stout spinules (fig. 23, 25, 26), hairs on apical portion of antennal segment 3 only slightly longer than the normal erect hairs

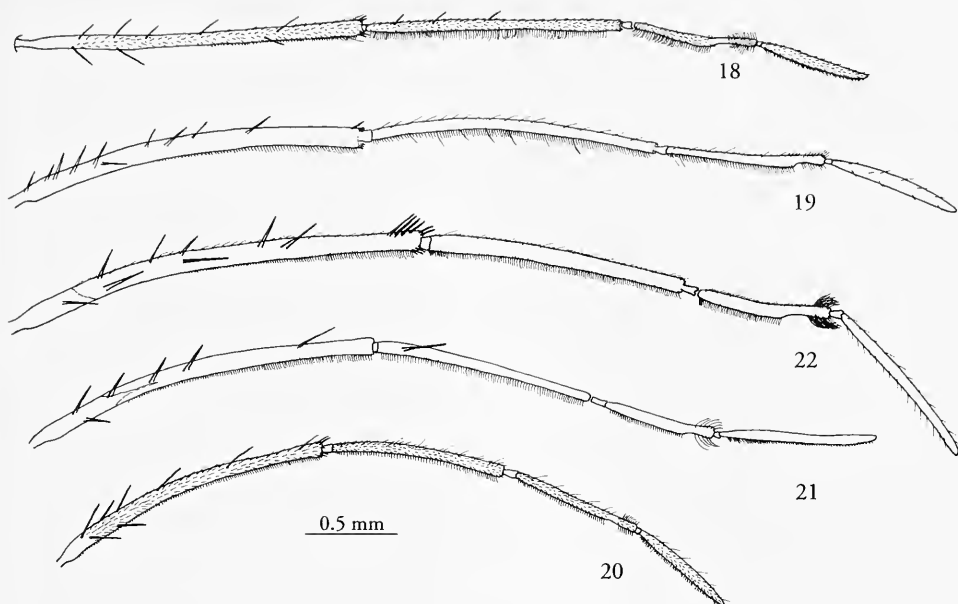
all over the length of the segment and shorter than width of segment at this location (figs. 18, 19)3

- Segment 2 of fore tarsus very long, surpassing the claws by more than their length (figs. 27, 28), fore tibia internally without a row of stout spinules, antennal segment 3 apically with conspicuous long hairs which are longer than width of segment at this location (fig. 22)5
3. Antennal segment 3 about 0.6 times as long as segment 2, straight and with a sharp indentation subapically, spinules on internal face of fore tibia distinctly increasing in length from base to tip and becoming hair-like in distal third, segment 8



Figs. 12-17. Lateral view of apterous form, showing colour pattern of pleura. – 12, *Ventidiid aquarius* (holotype); 13, *V. usingeri*; 14, *V. harrisoni* (paratype); 15, *V. malayensis*; 16-17, *V. longitarsus* (types).

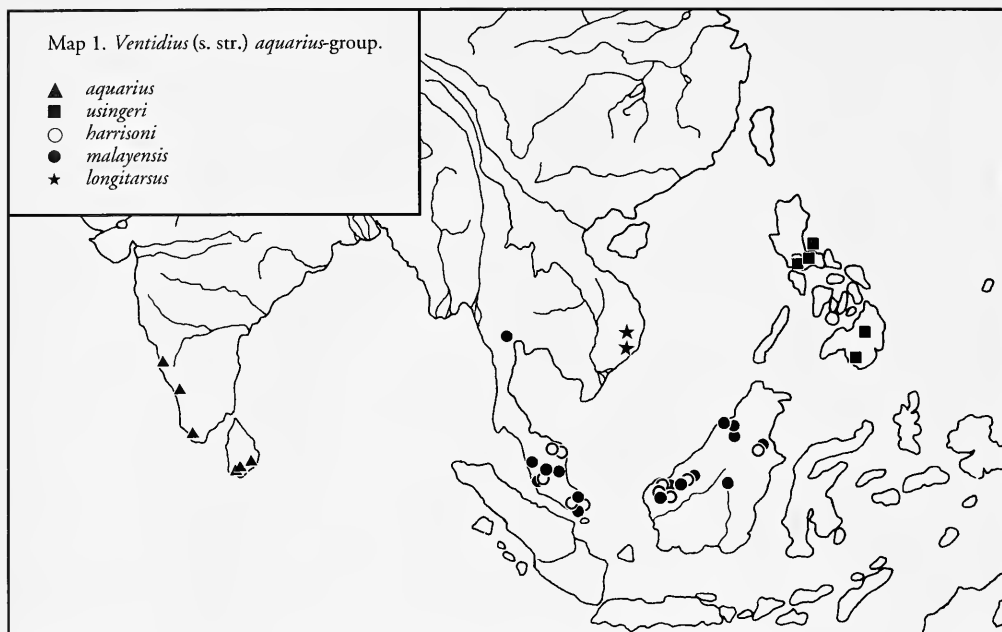
- with broader tuft of hairs ventrocaudally4
- Antennal segment 3 about 0.8 times as long as segment 2, with a very shallow indentation subapically (fig. 20); spinules on internal face of fore tibia only slightly increasing in length from base to tip and becoming only slightly thinner towards apex of tibia (fig. 26), segment 8 with narrow tufts of hairs ventrocaudally (fig. 41) (Malaya, Borneo) *V. harrisoni*
- 4. Mesopleural stripe ending at or at short distance from the second spiracle, ventral incision of segment 8 broad and less deep (fig. 40), parameres more straight and with numerous small hairs ventrally (fig. 44) (Philippines) *V. usingeri*
- Mesopleural stripe ending in middle of mesopleura in long distance from the second spiracle, ventral incision of segment 8 narrower and deeper (fig. 39), parameres more curved and without small hairs ventrally (fig. 43) (Sri Lanka, South India) *V. aquarius*
- 5. Segment 2 of fore tarsus very long (fig. 28), antennal segments 2-4 slightly thicker than in the following species, colouration variable (Viet Nam) *V. longitarsus*
- Segment 2 of fore tarsus slightly shorter (fig. 27), antennal segments 2-4 extremely thin, colouration always bright (Thailand, Malaya, Borneo) .. *V. malayensis*



Figs. 18-22. Dorsal view of male right antennae. — 18, *Ventidius aquarius*; 19, *V. usingeri*; 20, *V. harrisoni* (paratype); 21, *V. malayensis*; 22, *V. longitarsus* (holotype).

6. Pronotum completely black (fig. 54); distal part of parameres parallel-sided (fig. 96); thorax clothed with dense, long pubescence and fore femur slightly flattened (Sri Lanka, South India) ..
..... *V. henryi*
- Pronotum completely or mainly yellowish, or at least with a large yellowish mark in middle; distal part of parameres club-shaped or at least slightly dilated apically (figs. 102-113); either thorax without dense, long pubescence or fore femur not slightly flattened7
7. Antennal segment 1 very slender, 12.5-15 times as long as maximum width; thorax with less dense pubescence, sometimes relatively dense in dorsal part, but length of hairs on middle part of mesopleura short, distinctly shorter than that of the dark lateral band (which is sometimes lacking) (this character is not valid in a population from Viet Nam); paramere in distal part strongly widened and with a distinct tubercle (figs. 102-113); fore femur slightly flattened, at least basally (Sri Lanka, India, Thailand, Viet Nam, Malaya, Borneo, Sumatra, Java) *V. modulatus*
- Antennal segment 1 usually stouter and thickened in middle of its length, 9.5-11.5 times as long as maximum width in *V. hungerfordi* and *V. polhemorum*, 10.5-12.5 times as long as maximum width in *V. werneri* and *V. pilosus*. (but

- these species out of distribution of *V. modulatus*); thorax clothed with dense, long pubescence, length of hairs on mesopleura long, in its middle (in yellowish part) nearly of same length than that of dark lateral band which is always developed; parameres varied; fore femur not flattened8
8. Parameres distally strongly widened and with a distinct tubercle in most specimens (fig. 97), body depressed (Thailand, Malaya)
..... *V. hungerfordi*
- Parameres distally only slightly widened, without or with a faint indication of a tubercle, body depressed or not9
9. Paramere in middle part broad, about 0.7 times as broad as width of apical part, usually without a dimple at base of apical part (fig. 98), body more depressed, on average first antennal segment stouter (Borneo: Sabah, Sarawak)
..... *V. polhemorum*
- Paramere in middle part very slender, about half as broad as width of apical part, in most specimens with a very faint dimple at base of apical part, body less depressed, first antennal segment usually less thickened10
10. Paramere slightly twisted (fig. 100) (Indonesia: Sumba, Sumbawa) *V. pilosus*
- Paramere straight, not twisted (fig. 99) (Philippines: Palawan Province) *V. werneri*



* We were not able to check the type material of *V. distanti* and *V. sushmae*. Therefore, they are absent from the key. But according to the original descriptions and the illustrations, they both key out with *V. modulatus*.

The *Ventidius aquarius*-group

Diagnosis. – Comparatively larger size, length 3.38–4.60 (♂), 3.20–4.40 (♀); width 2.32–3.10 (♂), 2.30–2.96 (♀); with distinctively long and slender antennae; segment 1 shorter or subequal to segments 2 and 3 together, usually more than 1.20 mm; segment 2 in male usually much longer than segment 3 (except in *V. harrisoni*); antennal segment 1 with more than 8 long setae, in males segments 2 and 3 with dense erect hairs and segment 3 with a more or less distinct indentation near apex, which in some species is surrounded by a number of long thin setae apically; inner surface of fore tibia with dense and long setae, in distal part with a row of stout spinules forming an S-shaped comb, and in some species with a long row of stout spinules nearly all over its length; middle and hind legs distinctively stout and shining, with scattered long spines on femora and tibiae; segment 8 (s8) of male with a tuft of dark setae at each posterior angle, parameres small and symmetrical, straight or cucumber-shaped, never dilated apically; in three species endosoma with a third pair of lateral sclerites, which are very broad but with their distal parts slender and recurved backwards.

Distribution (map 1). – Widely distributed, from Sri Lanka to the Philippines and Borneo, not reaching Wallacea. Five species with allopatric distribution except *V. malayensis* and *V. harrisoni* which both inhabit the Southeast Asian mainland and Borneo.

1. *Ventidius* (s. str.) *aquarius* Distant (figs. 7-9, 12, 18, 23, 24, 29, 30, 39, 43, 48, map 1)

Ventidius aquarius Distant, 1910a: 150 (descr. of genus); Distant 1910b: 157–158 (descr., illustr. of species). Hungerford & Matsuda 1960: 324–325, 337 (descr., illustr., key). Thirumalai 1986: 10, 28–30 (list, descr., illustr.).

Type locality. – S. INDIA: Travancore.

Type material examined. – Holotype ♀, apt., 's. INDIA: Travancore, Pallode, 20 miles N.E. of Trivandrum (Annamdale)', 'on road side jungle stream (N. Annandale)' (BMNH).

Other material examined. – INDIA (South): 6♂ 15♀ apt., 2♂ 5♀ macr., Karnataka, Gersoppa, Jog Falls, 600 m, 19.–24.xi.1977, Zool. Mus. Copenhagen Exped. (ZMUC, NHMW); 2♂, 2♀ apt., Karnataka, Mudigere area, ca. 900 m, 2.–10.xi.1977, Zool. Mus. Copenhagen Exped. (ZMUC, PPCC); 2♂ 1♀ apt., Ammatti (S. Coorg), 3100 ft., 10.v.1951, leg. P.S. Nathan (JTPC); 1♀ apt., same locality, 11.1952 (JTPC); 2♂ 5♀ apt., 2♂ macr. Kerala, 15 km SW Munnar, Kallar Valley, 1250 m, 1.–9.v.1997, 10°02'N 76°58'E, leg. Dembicky & Pacholatko (NHMW, PPCC). SRI LANKA: 2♂ apt., Ratnapura, 20.ii.1961, leg. K.L.A. Perera (SEMC); 7♂ 3♀ apt., 2 larvae, Ambagaspihya, 1.ii.1961, leg. K.L.A. Perera (SEMC, JTPC); 4♂ 1♀ apt., 1♂ macr., Hiniduma, Ela, 29.i.1958, leg. K.L.A. Perera (SEMC); 1♂ 10♀ apt.,

South Prov., Udugama, N of Galle, 50 m, 22.x.1974, leg. N.M. Andersen (ZMUC, NHMW); 5♂ 2♀ apt., 2♀ macr., South Prov., Homadola, Udugama, Kan-eliya, from river pools, leg. P.B. Karunaratne (JTPC, NHMW); 1♀ macr., Uva Prov., Helagama, Meemina Hela-Large, pool at forest of hill, 500 ft., 7.-8.xii.1967, leg. P.B. Karunaratne (JTPC).

Redescription

Dimensions. – Apterous form, length 3.48 (♂), 3.62 (♀), width 2.40 (♂), 2.55 (♀), width of head 1.31 (♂), 1.31 (♀).

Colour (fig. 7). – Whole body prominently pale, with distinct dark stripes and marks. Eyes mainly dark brown to black, their inner margin brownish. Interoculus pale and its dark marks faint, along inner margin of eye with broad dark stripes reaching the posterior margin of vertex. Antennal segments dark, except basal 1/5 of segment 1. Pronotum yellowish, its anterior margin dark and with dark lateral marks. Mesonotum with dark lateral stripes. Posterior margin of metanotum dark and with a small triangular dark mark basomedially which is confluent with the dark mark of tergites, and with two more or less square dark lateral marks which are confluent with the dark strip of mesonotum; a transverse dark stripe along anterior margin of acetabula which broadens at external angle of mesonotum. Mesopleura yellowish with a broad longitudinal stripe running through its length, not reaching its anterior margin (fig. 12). Anterior margin and external angle of metacetabula dark (fig. 29, 30). Fore leg dark, femur with basal ½ yellowish (fig. 23). Middle and hind leg dark. Tergite 1 with two yellowish marks laterally, tergites 2-3 dark with a triangle-shaped yellowish mark in the centre, 4-8 yellowish with posterior margin dark. Laterotergites yellowish with dark posterior margins. Connexiva dark. Venter yellowish.

Pilosity. – Around antennal segment 1 scattered 12-14 long spinules, and with 7-8 distal short spinules, segment 2 with 6 spinules along its length, segment 3 with one distal spinule in female and a tuft of longer setae around the distal part in male, in distal part of segment 1 and all over the length of segments 2 and 3 ventrally with short erect dark hairs (fig. 18). Dorsum and pleura bearing dark pubescence, which is especially prominent on head. About 15 long setae along inner surface of fore femur, their lengths decreasing from basal to distal part. Fore tibia clothed by dense dark setae which form the whole tibia as a brush, but especially dense in distal part, and there with an S-shaped comb (fig. 23), in male along internal face with a row of stout spinules which are increasing in length and becoming more slender towards distal part. Long stiff spines scattered along middle and hind legs, tibiae with short stiff spinules. Basal part of middle and hind femora each with two very long trichobothria-like setae on dorsal surface,

the external one shorter than internal one. The trichobothria-like setae were lost in most specimens we have seen. Venter clothed by golden pubescence, on abdominal segments the pilosity longer and denser, ventral face of segment 8 of male with tufts of broader ranged (comparing with that in *V. harrisoni*) dark setae at each posterior angle (fig. 39).

Structural characters. – Interoculus narrower than width of an eye, 0.45 : 0.42 in males, 0.48 : 0.41 in females. Antennae distinctly long and slender, especially the second segment in male much longer than in most species (measurements see table 1); segment 3 modified at subdistal part, near apex with a deep indentation (fig. 18). Mesonotum swollen, its lateral width 1.52 (♂), 1.70 (♀). Intersegmental suture between meso- and metanotum distinct. Metanotum somewhat declivent. Lower half of hind margin of metacetabula rounded (slightly bilobate in caudal view), broad and nearly transverse in dorsal view (figs. 29, 30). Metasternal tubercle prominent in male. Anterior margin of abdominal tergite 1 visible; anterior margin of tergite 2 faint and obliterated strongly at medium part; anterior margin of tergite 3 arched forwards. Abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes.

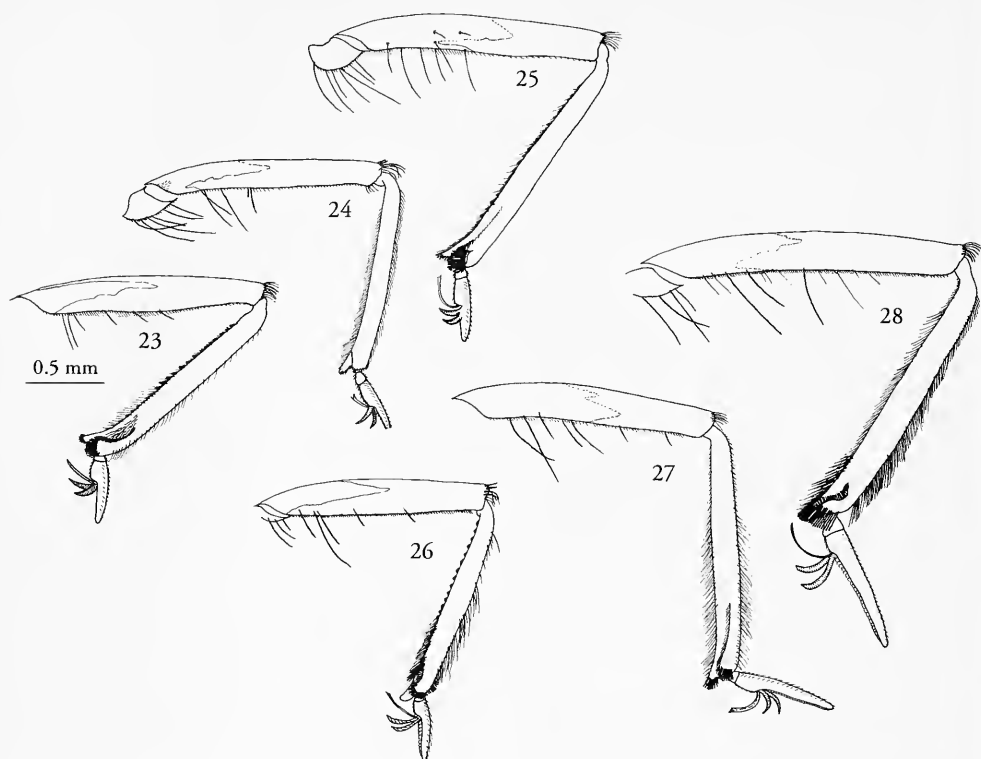
Male terminalia. – Parameres (fig. 43) small, symmetrical, more or less straight, cucumber-shaped, not extending beyond genital segments, with blunt apex. Endosoma (fig. 48): dorsal sclerite long and recurved proximally, ventral sclerite long, lateral sclerite straight, broadened at two ends, second lateral sclerites distinct, apical sclerite indistinct.

Female terminalia. – Abdominal sternite 7 large elevated medially, posterior margin concave forward.

Macropterous form. – Same as above with the following exceptions: apex of pronotum pointed (measurements see table 3); length of fore wings from humeri to apex 4.12. Yellowish mark of pronotum see figure 9.

Distribution (map 1). – S. India: Kerala. Sri Lanka: Sabaragamuwa (Ratnapura), Southern (Hiniduma), Prov.? (Ambagaspihya).

Comparative notes. – According to the relatively short segment 2 of fore tarsus, the row of stiff spines on fore tibia of males, and the shorter apical setae on segment 3 of antenna of males, *V. aquarius* is closely related to *V. harrisoni* and *V. usingeri*. The other two species of the group, *V. malayensis* and *V. longitarsus* sp. n., are easily distinguished by the long fore tarsi in both sexes. *Ventidius aquarius* shares the deep indentation in male segment 3 of antenna with *V. usingeri*, but differences are found in colour, in the deep semi-circular incision ventrally on segment 8 of males, and in the shape and absence of pubescence on the parameres.



Figs. 23-28. Dorsal view of right fore legs. – 23, *Ventidius aquarius* (male); 24, same species (female); 25, *V. usingeri* (male); 26, *V. harrisoni* (male, paratype); 27, *V. malayensis* (male); 28, *V. longitarsus* (male, holotype).

2. *Ventidius* (s. str.) *usingeri* Hungerford & Matsuda (figs. 6, 13, 19, 25, 31, 32, 40, 44, 49, map 1)

Ventidius usingeri Hungerford & Matsuda, 1960: 326-327 (descr., illustr., key).

Type locality. – PHILIPPINES: Los Baños (Luzon).

Type material examined. – PHILIPPINES: holotype ♂, macr., 'Los Baños, P.i., 17.vii.1936', 'R.L. Usinger collector', formerly belonged to Usinger collection (CNHM); allotype ♀, macr., 'CNHM-Philippines Zool., Exped. (1946-1947)', 'Borongkot, Upi, Cotabato Province, Mindanao 1500 ft. '47', and 'stream through original forest' (CNHM).

Other material examined. – PHILIPPINES: 11 ♂ 7 ♀ apt., 2 ♂ 2 ♀ macr., Quezon Province, W. Atimonan, Quezon NP, Old Zigzag Road, 12.ii.1996, leg. H. Zettel (zcwa, gclb, nhmw, pcc, uplb); 1 ♂ 7 ♀ apt., Luzon, Quezon Province, Quezon N.P., stream at entrance house, CL 1969, 10.vii.1985, leg. J.T. & D.A. Polhemus (jtpf, pcc); 1 ♂ 1 ♀ apt., 1 ♂ 1 ♀ macr., Luzon, Quezon Province, Quezon N.P., Nalubog Creek, CL 1971, 10.vii.1985, leg. J.T. & D.A. Polhemus (jtpf); 1 ♀ apt., Polillo Island, leg. Baker (FMHF); 3 ♂ 4 ♀ apt., 1 ♂ macr., Mindanao, Bukidnon Prov., Malaybalay, Kaamulan Site, 650 m, 12.11.1996, leg. H. Zettel (90d) (nhmw, uplb, pcc); 1 ♀ macr., Bukidnon Prov., Malaybalay, Kaamulan Site, 650 m, 6.-7.11.1996, leg. H. Zettel (90c) (nhmw).

Redescription

Dimensions. – Body length 3.65 (♂), 3.79 (♀), width 2.55 (♂), 2.68 (♀), width of head 1.40 (♂), 1.40 (♀).

Colour (fig. 6). – Whole body prominently yellowish, dorsal ground colour yellowish with distinct dark marks. Eye dark brown with grey lines. Interoculus pale, with a crescent dark mark along inner margin of eye in male, prominently smokey darkened in female, and the outline of dark mark rather obscure. Antennal segments black to brownish, except basal $\frac{3}{4}$ of segment 1 yellowish. Pronotum and mesonotum yellowish with dark lateral stripes. Metanotum dark at basal half and with a median triangular dark mark. Mesopleura with a brownish stripe running through its length, not reaching its anterior margin but connected with anteroexternal angle of metacetabula (fig. 13). Metacetabula with two yellowish marks (figs. 31, 32). Fore leg with yellowish fore femur, but apical $\frac{2}{5}$ more or less dark (fig. 25); tibia and tarsi dark. Middle and hind femora in male brownish, yellowish basally. Abdominal tergites and laterotergites in some specimens prominently yellowish; in some specimens

mainly dark. Connexiva 1-3 dark, the rest yellowish. Venter yellowish.

Pilosity. — Trichobothria on vertex conspicuous. Around antennal segment 1 with 10-12 long stiff dark spines; inner surface of segments 2-4 with dark short erect hairs (fig. 19). The hair around the constriction of male antennal segment 3 not specially modified. Pronotum and fore wing bearing dark pilosity. Pleura clothed with dark pubescence. Venter clothed by golden pubescence. Inner surface of male fore femur with 5-7 stiff spines except the long trichobothria-like pilosity; fore tibia clothed by dense dark setae which form the whole tibia as a brush, its inner surface in males with a dense row of dark spinules which short and stout at base and gradually becoming longer and thinner towards apex of tibia. Dark stiff spines scattered along middle and hind legs. Abdominal segment 8 of males with a tuft of dark setae at each corner of hind margin ventrally (fig. 40).

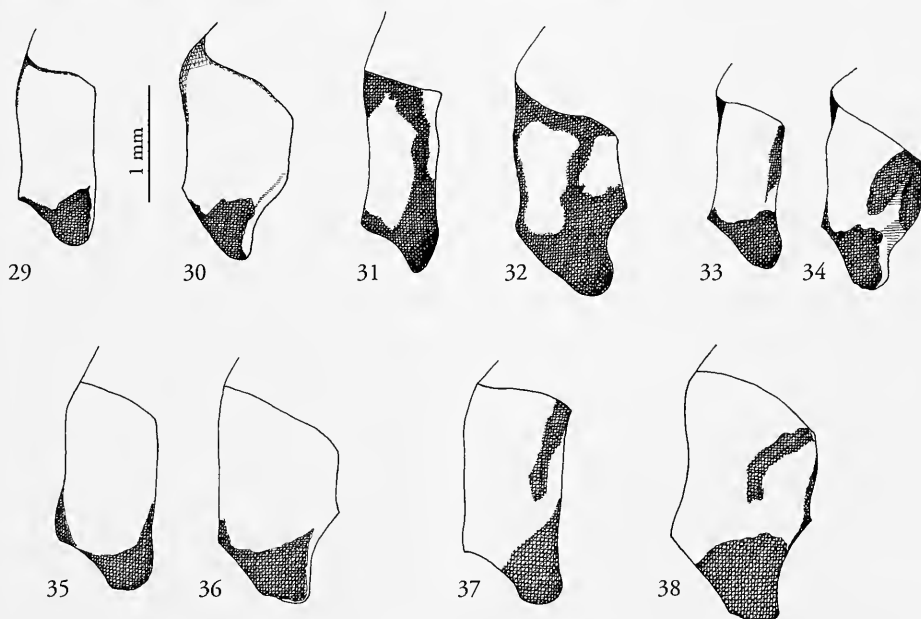
Structural characters. — Interoculus subequal to width of an eye, 0.51 : 0.48 in male, 0.47 : 0.46 in female. Antennae long, segment 2 much longer than 3 in male, slightly longer than 3 in female; subdistal part of the segment 3 constricted (fig. 19) in male (measurements see table 1). Pronotum more or less triangular (measurements see table 3). Lateral width of body 1.45 (♂), 1.66 (♀). Lower part of metacaterabula obtusely triangular in caudal view (figs. 31,

32). Length of wing 3.00 (♂), 3.50 (♀). Metasternum keel-shaped, distinctly projecting backwards. Fore femur slender and not modified, claws rising from $\frac{1}{3}$ of second tarsal segment. Anterior margin of tergite 1 indistinct, anterior margin of tergite 2 faint and obliterated strongly at medium part, anterior margin of tergites 3 arched forwards. Abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes.

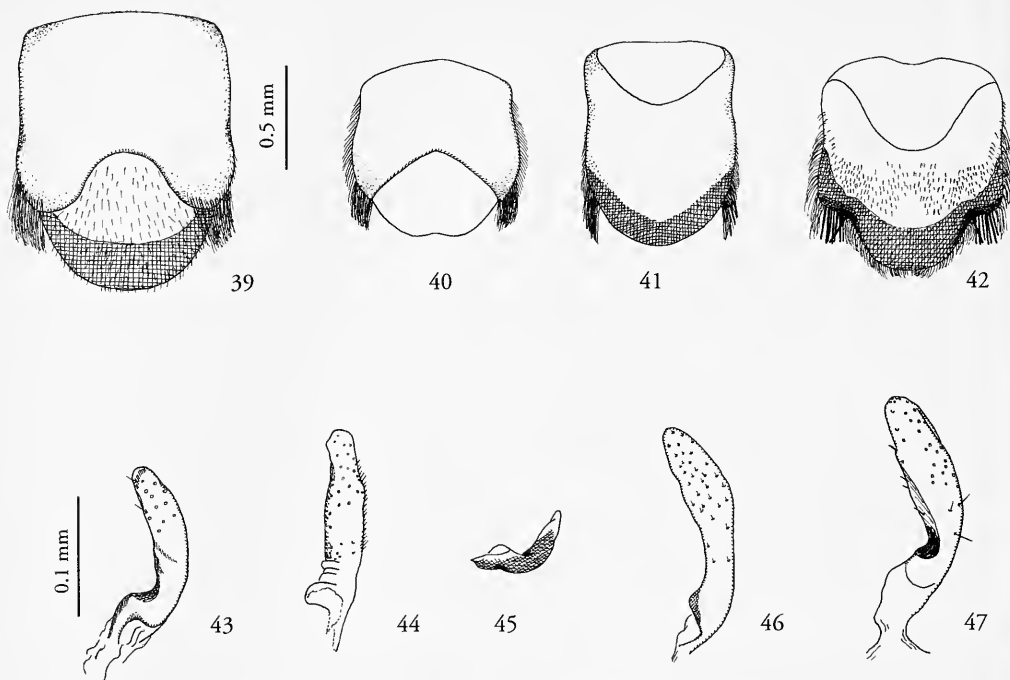
Male terminalia. — Parameres (fig. 44) very small, symmetrical, both bar-shaped, with blunt apex; not extending beyond genital segments. Endosoma (fig. 49): dorsal sclerite long and recurved proximally, ventral sclerite long, lateral sclerite more or less straight, broadened and curved at two ends, second lateral sclerites long and thin, third lateral sclerites irregularly shaped, apical sclerite not visible.

Macropterous form. — Same as above with the following exceptions: apex of pronotum pointed (measurements see table 3); length of fore wings from humeri to apex 3.00 (♂) 3.40 (♀). Pronotum yellowish with two dark marks at anterior margin and one thick transverse band between humeral angles which is interrupted at median line, lower part of pronotum with dark margins.

Distribution (map 1). — Philippines: Luzon (Laguna, Quezon), Polillo Island, Mindanao (Cotabato South, Bukidnon).



Figs. 29-38. Right metacaterabula of female; odd numbers: dorsal view, even numbers: dorsolateral view. — 29, 30, *V. aquarius*; 31, 32, *V. usingeri*; 33, 34, *V. harrisoni* (paratype); 35, 36, *V. malayensis*; 37, 38, *V. longitarsus*.



Figs. 39-47. — 39-42, Ventral view of male abdominal sternites VIII, showing the pilosity; 43-46, External view of left paramere. — 39, 43, *Ventidius aquarius*; 40, 44, *V. usingeri*; 41, 45, *V. harrisoni* (paratype); 42, 46, *V. malayensis*, 47, *V. longitarisus* (paratype).

Comparative notes. — This species is very similar to *V. aquarius* (from South India and Sri Lanka), for differences see under the comparative notes for that species.

3. *Ventidius* (s. str.) *harrisoni* Cheng (figs. 14, 20, 26, 33, 34, 41, 45, 50, map 1)

Ventidius harrisoni Cheng, 1965: 155-158, 163 (descr., illustration, key); Kovac & Yang 1989: 285 (rec.).

Type locality. — SINGAPORE.

Type material examined. — Holotype ♂, apt., SINGAPORE: Seletar River (Sungai Seletar) (1°24'N., 103°47'50' E.), 10.iv.1964 (BMNH). Paratypes, 5♂ 5♀, apt., same locality data as holotype (BMNH, ZRCS).

Other material examined. — SINGAPORE: 11♂ 9♀ apt., 46 larvae, Lower Peirce, forest stream, J, Dharmapathy, 6.xi.1991, coll. C.M. Yang (ZRCS, PPCC, NHMW); 10♂ 15♀ apt., MacRitchie, up stream, 17.vi.1994, NS161A (ZRCS, PPCC, NHMW); 1♂ 6♀ apt., 3 larvae, Nee Soon, Swamp forest, 13.vi.1994, NS159B (ZRCS); 6♂ 11♀ apt., 5 lv., MacRitchie Reservoir, SICC nr. plot 4, 28.v.1993, leg. C.M. Yang et al., NS104 (ZRCS, NHMW); 10♂ 13♀ apt., Nee Soon swamp forest and drain, 13.x.1986, CL 2214, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 1♀ apt., Chestnut Drive, 5.v.1994, NS128A (ZRCS); MALAYSIA: 6♂ 7♀ apt.,

North Selangor, Peat Swamp Forest, stream at 0.2 km from 45 km mark road to Sungai Bosar., 17.vi.1991, 152 (ZRCS, PPCC); 6♂ 4♀ apt., 1 larva, North Selangor, Peat Swamp, Forest stream, at 50 km mark to Tanjong Malim, 18.vi.1991, 156, leg. H.K. Lua, Mala (ZRCS, NHMW); 1♂ 2♀ apt., 4 larvae, Selangor, Sabak Bernam, 43 km to sg. Besar fm. Tg. Malim, coll. T.R. Lim (ZRCS); 3♂ 16♀ apt., 13 larvae, Selangor, peat swamp forest, 25.iii.1994, leg. K.L. Yeo (ZRCS, NHMW); 3♂ 7♀ apt., Johor, Gunung Pantii, track 270, 22.i.1991, Y734, Leg. K.L. Yeo (ZRCS, NHMW); 1♀ apt., Johor, Sg. Temetang, between Kota Tinggi and Jemlung, 28.4.1993, Y828, leg. C.M. Yang (ZRCS); 2♂ apt., Johor, Tg. Sedili, Sg. Selangi, muddy water, sandy bottom, up to 1.5 feet water, Coll. K.L. Yeo & Chia Yi 22.iv.1992 (ZRCS); 2♂ apt., Johor, swamp forest stream, 61 km NE of Johor Bharu on Mersing road, 16.x.1986, CL 2220, J.T. & D.A. Polhemus (JTPC); 1♂ 1♀ apt., Johor, swamp forest stream, 15 km W of Sedili Besar, 20 m, 16.x.1986, CL 2218, leg. J.T. & D.A. Polhemus (JTPC); 1♂ 1♀ apt., Johor, Sg. Mupoh, 14.x.1964, leg. L. Cheng, ZRCS&6471-6472 (ZRCS); 1♂ apt., 788L, Johor, S. Bong, 5.iv.1992, leg. K.L. Yeo (ZRCS); 1♂ 1♀ apt., Terengganu, north of Ayer Puteh, about 121 km on road from Kuantan to Kuala Terengganu, 19.iii.1992, L181, leg. H.K. Lua (ZRCS); 6♂, 3♀ apt., Kelantan, waterfall 10 km NW of Pasir Puteh, CL 2084, 21.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 3♂ 4♀ apt., Sarawak, Semengoh, NSG, 30 km S. Kuching, 17.ii.1993, leg. H. Zettel (2) (NHMW, PPCC); 1♂ 3♀ apt., Sarawak (Borneo), Rumah Kabau anak

muggot, Ng sebong Baleh, 25 km E. Kapit, III.1994, leg. J. Kodada (NHMW); 1♂ apt., Sarawak, ca. 40 km SE Kapit, Rumah Ugap Ng, marating bena Kapit, III.1994, leg. J. Kodada (NHMW); 1♂ apt., Sarawak (Borneo), Tapah Riv., 16 km NW of Bau, CL 2052, 10.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); 2♂ 4♀ apt., Sarawak (Borneo), 4 km S Tebakang, 19.viii.1985, CL 2044, leg. J.T. & D.A. Polhemus (JTPC, PPCC); 1♂ apt., Sarawak (Borneo), Kampong Pueh, Lundu District, 690-1500 m, 6.-12.vi.1958, leg. T.C. Maa (BIMC); 1♀ apt., Sarawak, Kapit District, Merirai V., 30-300 m, 1.-6.viii.1958, secondary forest, leg. T.C. Maa (BIMC); 1♂ apt., Sarawak (Borneo), 8 km S of Tebakang, stream disappearing into cave, CL 2046, 9.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); INDONESIA: 4♂, 6♀ apt., Kalimantan Timur, Long Bagun Ulu, 14.i.1995, leg. Seyfert & Graindl (9) (NHMW, PPCC).

Redescription

Dimensions. – apterous form, length 3.38 (♂), 3.20 (♀), width 2.32 (♂), 2.30 (♀), width of head 1.30 (♂), 1.26 (♀).

Colour. – Whole body prominently pale, with distinct dark stripes and marks. Eyes dark brown, their inner margin blackish. Interoculus pale, along inner margin of eye with dark stripe reaching the posterior margin of vertex. Antennal segments dark, except basal 1/5 of segment 1. Pronotum yellowish, its anterior margin dark and with lateral dark marks. Mesonotum with lateral dark stripes. Posterior margin of metanotum dark and with a triangular dark mark basomedially which is confluent with the dark mark of abdominal tergites. Mesopleura yellowish with a broad longitudinal stripe running through its length (fig. 14). Dark mark of metacetaula see figs. 33, 34. Fore leg dark, femur with basal 2/3 yellowish (fig. 26). Middle and hind leg dark. All tergites and laterotergites yellowish with posterior margin dark in female, male tergite 8 totally dark. Connexiva 1-4 dark. Venter yellowish.

Pilosity. – Around antennal segment 1 12-14 scattered long spines and with 7-8 distal short spines, segment 2 with 3 spines, segment 3 with one distal spinule in female and a tuft of longer setae around the distal part in male, all antennal segments with dense dark short erect hairs (fig. 20). Dorsum and pleura bearing dark pubescence, which is especially prominent on head. More than 10 long setae along inner surface of fore femur, their lengths decrease from basal to distal part; fore tibia clothed by dense dark setae which form the whole tibia as a brush, its distal part with an S-shaped comb (fig. 20), internal face in males with a dense row of short and stout spinules which are only slightly increasing in length towards apex. Long stiff spines scattered along middle and hind legs, tibiae with short stiff spinules. Venter clothed by golden pubescence, on abdominal sternites the pilosity longer and denser, ventral face of segment 8 of male with a narrow tuft of dark setae at each posterior angle (fig. 41).

Structural characters. – Interoculus equal to width of an eye, 0.44 and 0.44 in males, 0.42 and 0.42 in females. Antennae distinctly long and slender, especially the second segment in male much longer than usual (measurements see table 1); segment 3 modified at distal part, near apex with a shallow indentation (fig. 20). Mesonotum swollen, its lateral width 1.47 (♂), 1.60 (♀). Intersegmental suture between meso- and metanotum distinct and marked by a brown line. Metanotum somewhat declivent. Lower half of hind margin of metacetaula slightly bilobate, broad and nearly transverse from dorsal view (figs. 33, 34). Metasternal tubercle prominent in male. Anterior margin of abdominal tergite 1 visible; anterior margin of tergite 2 clear and obliterated strongly at medium; anterior margin of tergite 3 arched forwards. Abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes. Laterotergites broad.

Male terminalia. – Parameres (fig. 45) small, symmetrical, slightly hooked, slightly curved upwards, not extending beyond genital segments, with blunt apex. Endosoma (fig. 50): dorsal sclerite long and recurved proximally, ventral sclerite long, lateral sclerite straight, broadened at two ends.

Female terminalia. – Abdominal sternite 7 large, elevated medially, posterior margin concave forward.

Macropterous form. – Unknown.

Distribution (map 1). – Malaysia: Selangor, Johor, Trengganu, Kelantan, Sarawak; Singapore; Indonesia: Kalimantan Timur.

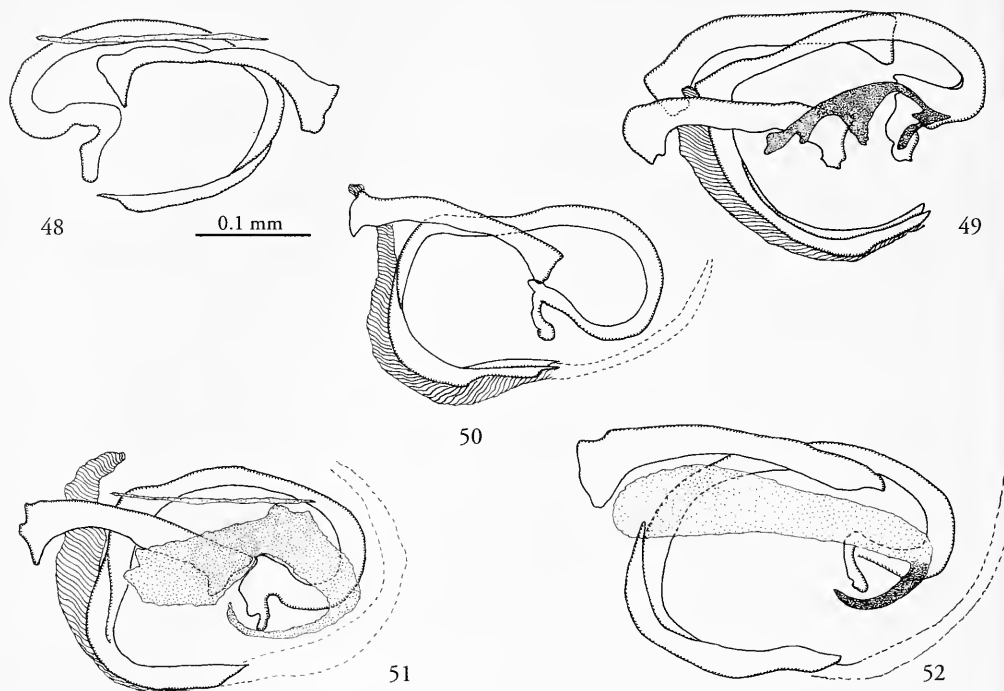
Comparative notes. – *Ventidius harrisoni* is closely related to *V. aquarius* and *V. usingeri* by the characters mentioned under the comparative notes of *V. aquarius*. Differences to these species are found in males: the antennal segment 3 which has only a very shallow indentation subapically, the spines of the clasping comb on fore tibia which are only slightly increasing in length from base to tip and becoming only slightly thinner towards apex of tibia, and the segment 8 with a small tuft of hairs laterally. In some samples we found *V. harrisoni* mixed with *V. malayensis*, from which it differs in length of fore tarsi in both sexes.

4. *Ventidius* (s.str.) *malayensis* Hungerford & Matsuda (figs. 10, 11, 15, 21, 27, 35, 36, 42, 46, 51, map 1)

Ventidius malayensis Hungerford & Matsuda, 1960: 325-326, 336 (descr., illustr., key); Kovac & Yang 1989: 285 (rec.).

Type locality. – MALAYSIA: Selangor.

Type material examined. – Holotype ♂ and allotype ♀, Malaya, Selangor, F.M.S., Sungai Ampang, 15.Aug.1926, C. Dover, Ex. Coll. F.M.S.: Museum (BMNH). The holotype also labelled 'Ventidius aquarius Dist., det. Teiso Esaki', the allotype bears the label 'Metrocoris aquarius Dist., det. Dover 26'.



Figs. 48-52. Lateral view of endosoma sclerites. – 48, *Ventidius aquarius*; 49, *V. usingeri*; 50, *V. harrisoni* (paratype); 51, *V. malayensis*; 52, *V. longitarsus* (paratype).

Other material examined. – THAILAND: 1 ♂ 1 ♀ apt., Kanchanaburi, Sai Yok waterfall, river Kwai, VIII.1979, leg. B. Petersen (ZMUC); 4 ♀ apt., Kanchanaburi, Sai Yok, waterfall, 21.-22.xii.1981, leg. N.M. Andersen (ZMUC); SINGAPORE: 4 ♂ 1 ♀ apt., 16.5 miles Mersing, Mersing Kluang Rd., 4.viii.1963, leg. L. Cheng (BMNH); 1 ♀ apt., Nea Soon, swamp forest, 13.vi.1994, NS159B (ZRCs); MALAYSIA: 3 ♂ 7 ♀, Iv, Pahang, S. Seladang, 13. and 19.vii.1989, leg. K.L. Yeo & E. Koh, ZRCs 6.2619-2632 (ZRCs, NHMW); 2 ♀ apt., Pahang, S. Kernam, 19.vii.1989, leg. K.L. Yeo, ZRCs 6.2634-2635 (ZRCs); 1 ♀ apt., Pahang, S. Kinchin, 13.vi.1989, leg. C.M. Yang (ZRCs); 1 ♂ apt., Johor, Taku, 19.vii.1989, leg. K.L. Yeo, ZRCs 6.2633 (ZRCs); 1 ♂ apt., 5lv, Johor, S. Marong, 5.iv.1992, 788M, leg. K.L. Yeo (ZRCs); 1 ♂ 4 ♀ apt., 788L, Johor, S. Bong, 5.iv.1992, leg. K.L. Yeo (ZRCs, NHMW); 1 ♂ 1 ♀ apt., Johor, stream 12 km N of Labis, CL 2087, 22.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); 6 ♂, 9 ♀ apt., Johor, 27 km S of Mersing, slow shaded stream, CL 2058, 14.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, PPEC); 4 ♀ apt., Johor, Endau, Sg. Anak Jasin, 4.iv.1992, L186, leg. H.K. Lua (ZRCs); 1 ♂ 3 ♀ apt. 5lv., Johor, S. Anak, Jasin, Y788D2, leg. K.L. Yeo, 4.iv.1992 (ZRCs); 5 ♂, 5 ♀ apt. 1 ♂ macr., Perak, stream 58 km S of Grik, CL 2077, 19.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 2 ♀ apt., Upper Perak, Longgong, surface of irrigation channel, fast water, 22.x.-5.xi.1926 (BMNH); 2 ♀ apt., Sarawak (12), Kelabit Highland, 5 km E Bareo, Pa Ukat 1000 m, 27.ii.1993 (a) mäandrierender ca 6 m breiter

Fluß, leg. H.Zettl (NHMW); 2 ♀ apt., Sarawak, Mulu N.P., 3-5.iii.1993, leg. H. Zettl (14), (e) rechter Zufluß des Tutoh River bei Long Iman, ca. 8 m breit, 4.3. (NHMW); 1 ♂ 1 ♀ apt., Sarawak, Nanga Pelagus nr. Kapit, 180-585 m, 7-17.viii.1958, T.C. Maa Collector (BIMC); 1 ♀ apt., Sarawak, Sadong, Kampong Tapuh 300-450 m, 10.vii.1958, T.C. Maa, Collector, BISHOP (BIMC); 1 ♂ 4 ♀ apt., Sarawak, Kapit Dist., Merirai V., 30-300 m, 1-6.viii.1958, Secondary Forest, T.C. Maa Collector, No. MB164 (BIMC, SEMC); 4 ♂ apt., Sarawak, Sameran River, 2 km W of Tube, CL 2047, 19.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); 9 ♂ 10 ♀ apt., Sarawak (Borneo), Tapah Riv., 16 km NW of Bau, CL 2052, 10.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW, PPEC); 1 ♀ apt., Sabah, Tibow Estate, slow flow stream, MB42, 25.5.1996, leg. T.B. Lim (ZRCs); BRUNEI: 1 ♂ apt., Temburong, Belalong Field Res. Centre, Sungai Belalong, 60 m, 2-8.v.1995, leg. E. Heiss (ZCWA); INDONESIA: 9 ♂ 23 ♀ apt., 4 ♂ 7 ♀ macr., Kalimantan Timur Province, Borneo, waterfall and stream, 11 km NE of Samarinda, CL 2091, 27.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW, PPEC); 1 ♂ 1 ♀ apt., C. Borneo, Sg. Birang, leg. Mjöberg 1925, Coll. Dr. D. MacGillavry (ZMAC).

Redescription

Dimensions. – Apterous form, length 4.02 (♂), 4.26 (♀), width 2.90 (♂), 2.93 (♀), width of head 1.60 (♂), 1.55 (♀).

Colour. – Whole body prominently pale, with distinct dark stripes and marks (fig. 11). Eyes mainly dark brown to blackish, their margins greyish. Interoculus pale with three obscure long dots, which are not connected with margin of vertex, along inner margin of eye dark which is confluent with the dark mark of pronotum. Antennal segments dark, except basal 2/5 of segment 1. Pronotum yellowish with lateral dark marks which are more prominent anteriorly. Mesonotum with lateral dark stripes. Metanotum with a large triangle-shaped dark mark basomedially which is confluent with the dark mark of tergites, and with two irregular lateral dark marks which are confluent with the dark stripes of mesonotum. Mesopleura yellowish with a broad longitudinal stripe running through its length (fig. 15); external angle of metacetaula dark (fig. 35, 36). Fore leg dark, femur with basal 1/2 of fore femur yellowish (fig. 27). Middle and hind legs dark. Tergite 1 along anterior margin yellowish, the triangle-shaped dark mark confluent with a dark mark of metanotum; tergites 2-8 dark laterally with a median yellowish mark which varies individually. Laterotergites yellowish. Connexiva either black or 1-4 blackish, 5-7 brownish. Venter yellowish.

Pilosity. – Around antennal segment 1 7-8 scattered long spinules, and with 5-6 distal short spinules, segment 2 with one subbasal spinule, segment 3 with a tuft of longer setae around the distal part, all antennal segments with silvery fine hair fringe. Dorsum and pleura bearing dark pubescence, especially prominent on head. Circa 20 long setae along inner surface of fore femur, their length decreasing from base to apex; fore tibia clothed by dense dark setae which form the whole tibia as a brush, its distal part with an S-shaped comb (fig. 27). Long stiff spines scattered along middle and hind legs, tibia with shorter stiff spinules. Basal part of middle and hind femora with two very long trichobothria-like setae on dorsal surface respectively, external one shorter than internal one. Venter clothed by golden pubescence, on genital segments the pilosity slightly longer and denser, ventral face of segment 8 of male with a tuft of broader range (compared with the case in *V. harrisoni*) dark setae at each posterior angle from ventral view (fig. 42).

Structural characters. – Interoculus subequal to width of an eye, 0.55 : 0.50 in males, 0.51 : 0.56 in females. Antennae distinctly long and slender, especially segment 2 in male much longer than usually (measurements see table 1); segment 3 modified at distal half, near apex with a shallow indentation (fig. 21). Thorax bulbous, mesonotum swollen, its lateral width 1.93 (♂), 1.96 (♀). Intersegmental suture between meso- and metanotum faint but visible. Metanotum somewhat declivent. Lower half of hind margin of metacetaula slightly bilobate, broad and

nearly transverse from dorsal view (figs. 35, 36). Metasternal tubercle prominent in male. Anterior margin of abdominal tergite 1 visible; anterior margins of tergites 2 and 3 faint, obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes. Laterotergites broad.

Male terminalia. – Parameres (fig. 46) small, symmetrical, more or less straight, slightly curved upwards, not extending beyond genital segments, with blunt apex. Endosoma (fig. 51): dorsal sclerite long and recurved proximally; ventral sclerite long; first lateral sclerites straight, broadened and curved at two ends; second lateral sclerites slender and long; third lateral sclerite broad, distal part slender and recurved backwards; apical sclerite indistinct.

Female terminalia. – Abdominal sternite 7 large, elevated medially, sometimes keel-like, posterior margin concave forward.

Macropterous form. – As apterous form with the following exceptions: apex of pronotum bluntly pointed (measurements see table 3); length of fore wings from humeri to apex 3.30. Dark mark of pronotum see fig. 10.

Variations. – Specimens from Borneo show small differences in relative lengths of antennal segments and colour of pronotum; the Bornean population is regarded as of infrasubspecific rank.

Distribution (map 1). – Thailand: Kanchanaburi; Malaysia: Selangor, Pahang, Johor, Perak, Sarawak, Sabah; Singapore; Brunei; Indonesia: Kalimantan Timur.

Comparative notes. – This species is very closely related to *V. longitarsus* sp. n. It differs from the other species of the group (*V. aquarius*, *V. harrisoni*, and *V. usingeri*) by longer fore tarsi, by lacking a row of stiff spines on male fore tibia, and by long hairs apically on segment 3 of males. For differences between *V. malayensis* and *V. longitarsus* sp. n. see comparative notes of that species.

5. *Ventidius* (s. str.) *longitarsus* sp. n. (figs. 16, 17, 22, 28, 37, 38, 47, 52, 53, map 1)

Ventidius (s. str.) sp.: Zettel & Chen 1996: 152, 180 (list, rec.).

Type locality. – VIET NAM: Da Lai Province, Mdrak, E of Ban Me Thuot.

Type material. – Holotype: ♂, apt., VIET NAM: [Da Lak Province] Mdrak E. of Ban Me Thuot, 4-600 m, 8-19.xii.1960, C.M. Yoshimoto collector (BIMC). – Paratypes: 1 ♂ 2 ♀ apt., same locality data as holotype (BIMC, NHMW); 2 ♂, 5 ♀ apt., Gia Lai-Kontum Prov., 40 km NW Ankhe, Buon Luoi, 14°10'N, 108°30'E, 620-750 m, 28.iii.-12.iv.1995, leg. Pacholatkó & Dembicky (NHMW, PPCC).

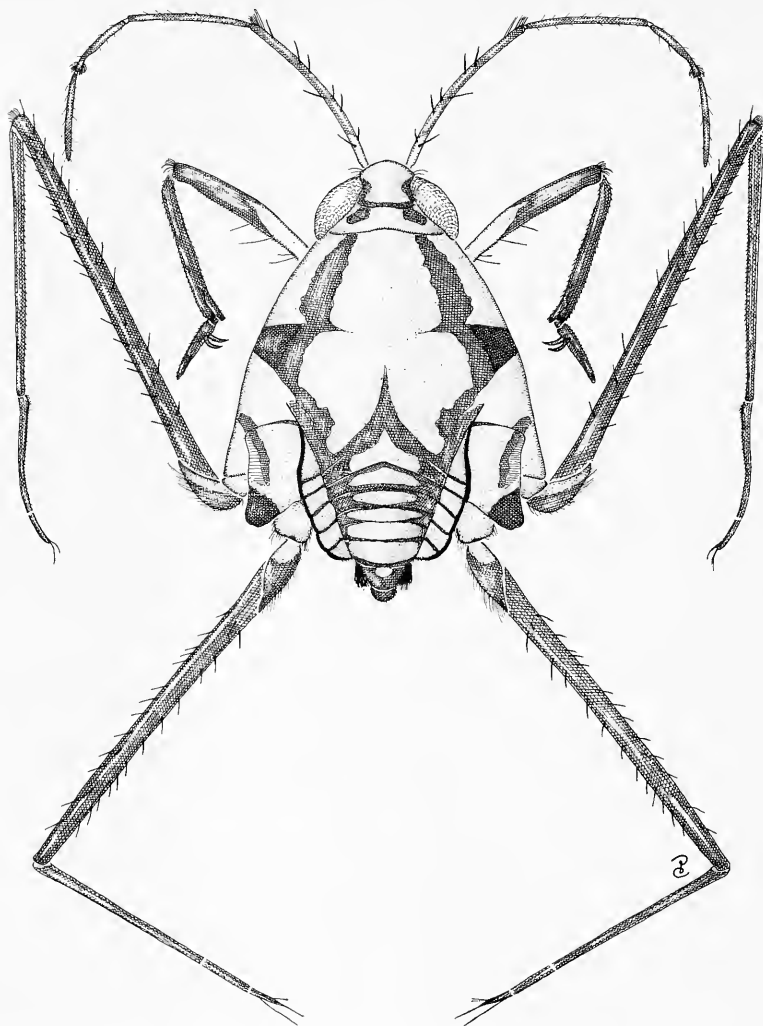


Fig. 53. *Ventidius* (s. str.) *longitarsus*, holotype, apterous male, length 4.60 mm.

Etymology. — This species is named after the long fore tarsus of male.

Description

Dimensions. — apterous form, length 4.60 (♂), 4.40 (♀), width 3.10 (♂), 2.96 (♀), width of head 1.65 (♂), 1.61 (♀).

Colour (fig. 53). — Whole body prominently pale, with distinct dark stripes and marks. Eyes mainly dark brown to blackish, their margins greyish. Interoculus pale with three obscure long dots, not connected with margin of vertex, along inner margin of eye dark posteriorly which is confluent with the dark mark of pronotum. Antennal segments dark, except

basal 2/5 of segment 1. Pronotum yellowish with dark lateral mark which is more prominent anteriorly. Mesonotum with dark lateral mark. Metanotum with a triangle-shaped dark mark basomedially which is confluent with the dark mark of tergites, and with two irregular-shaped dark lateral marks which are confluent with the dark strip of mesonotum. Mesopleura yellowish with a broad longitudinal stripe running through its length (figs. 16, 17); external angle of metacetabula dark (figs. 37, 38). Fore leg dark, femur with basal ½ yellowish (fig. 28). Middle and hind legs dark. Tergite 1 along anterior margin yellowish, the triangle-shaped dark mark confluent with dark mark of metanotum; tergites 2-8 dark laterally

with a median yellowish mark which varies individually. Laterotergites yellowish. Connexiva either totally black or 1-4 brownish and 5-7 yellowish. Venter yellowish.

Pilosity. – Around antennal segment 1 7-8 scattered long spinules, and with 5-6 distal short spinules, segment 2 with one subbasal and one subdistal spinules, segment 3 with a tuft of longer setae around the distal part, all antennal segments with silvery fine hair fringe (fig. 22). Dorsum and pleura bearing dark pubescence, which is especially prominent on head. Circa 20 long setae along inner surface of fore femur, their lengths decrease from basal to distal part; fore tibia clothed by dense dark setae which form the whole tibia as a brush, its distal part with an S-shaped comb (fig. 22). Long stiff spines scattered along middle and hind legs, tibia with shorter stiff spinules. Basal part of middle and hind femora with two very long trichobothria-like setae on dorsal surface respectively, the external one shorter than internal one. Venter clothed by golden pubescence, on genital segments the pilosity slightly longer and denser, ventral face of segment 8 of male with a tuft of broader ranged (compared with the case in *V. harrisoni*) dark setae at each posterior angle from ventral view.

Structural characters. – Interoculus broader than width of an eye, 0.63 and 0.52 in males, 0.58 and 0.51 in females respectively. Antennae distinctly long and slender, especially segment 2 in male much longer than usual (measurements see table 1); segment 3 modified at distal half, near apex with an indentation (fig. 22). Thorax bulbous, mesonotum swollen, its lateral width 1.95 (♂), 2.00 (♀). Intersegmental suture between meso- and metanotum faint but visible. Metanotum somewhat declivent. Lower half of hind margin of metacetabula slightly bilobate, broad and nearly transverse from dorsal view (figs. 37, 38). Metasternal tubercle prominent in male. Anterior margin of abdominal tergite 1 visible; anterior margins of tergites 2 and 3 faint, obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes. Lateral tergite plate broad.

Male terminalia. – Parameres (fig. 47) small, symmetrical, more or less straight, inner surface with indentation at basal half, not extending beyond genital segments, with blunt apex. Endosoma (fig. 52): dorsal sclerite long and recurved proximally, ventral sclerite long, lateral sclerite straight, broadened at proximal end, second lateral sclerite long oblique and distinct, the third lateral sclerite broad, darkened and curved at distal part, apical sclerite indistinct.

Female terminalia. – Abdominal sternite 7 large, elevated medially, posterior margin concave forward. Macropterous form. – Unknown.

Distribution (map 1). – Viet Nam: Da Lak, Gia

Lai-Kontum.

Comparative notes. – This species is very similar to *V. malayensis* Distant, but has larger size and darker colouration. Main difference is the very long segment 2 of male fore tarsus (see table 2), with claws arising from basal 1/6 of the segment.

The *Ventidius modulatus*-group

Diagnosis. – Comparatively smaller size, length 2.41-3.00 (♂), 2.50-3.10 (♀), width 1.64-1.90 (♂), 1.74-2.20 (♀); length of antennae intermediate; segment 1 longer or subequal to segments 2 and 3 together, usually less than 1.20 mm; length of segment 2 in male not or slightly longer than segment 3 (up to 1.4 times); antennal segment 1 usually with less than 8 long setae, in males segments 2-4 with dense erect silvery pubescence and segment 3 without indentation near apex; inner surface of fore tibia with dense setae, in distal part with a row of stout spinules forming an S-shaped comb, never with a long row of stout spinules; middle and hind legs distinctly more slender than in the *V. aquarius*-group; segment 8 (s8) of male without tufts of dark setae at each posterior angle, parameres small and symmetrical, usually distinctly dilated apically (except in *V. henryi*); in three species endosoma with a third pair of lateral sclerites, which are very broad only at distal part slender and recurved backwards.

Distribution (maps 2, 3). – Widely distributed in Oriental region, from Sri Lanka to Philippines (Palawan region) and Borneo, in the east reaching the Wallacea (Sumbawa and Sumba), but unknown from Sulawesi.

6. *Ventidius* (s. str.) *henryi* Esaki

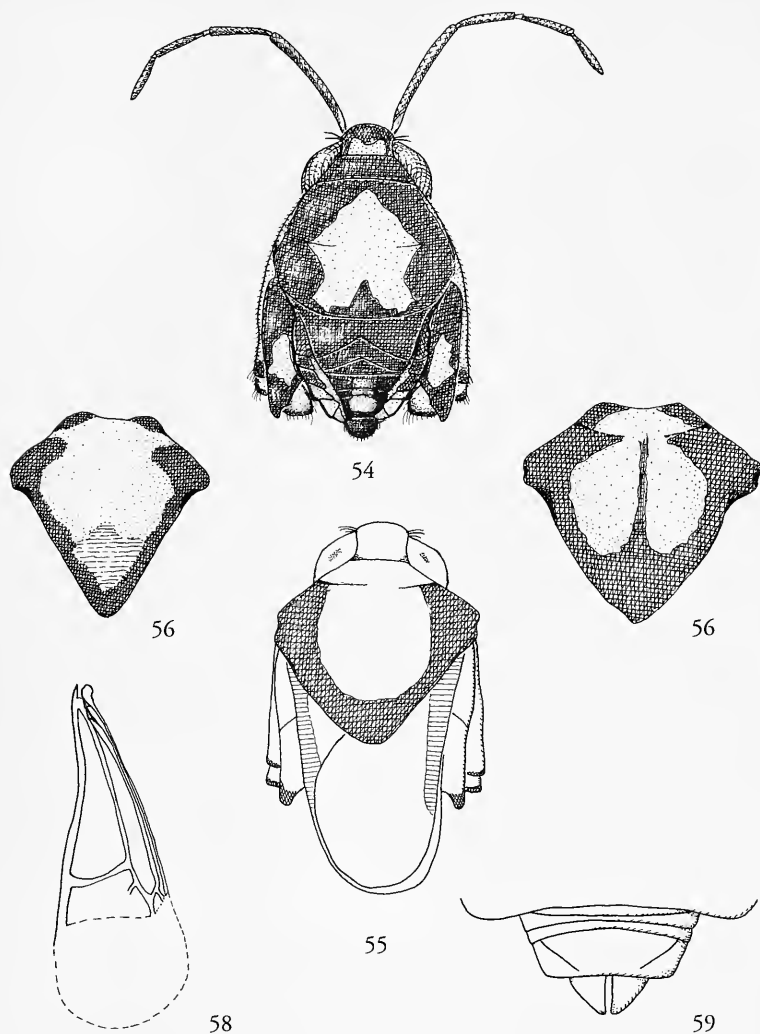
(figs. 54, 55, 60, 67-69, 75, 76, 88, 96, 114, map 2)

Ventidius henryi Esaki, 1928: 509-511 (descr., illustr.); Lundblad 1933: 372 (list); Hungerford & Matsuda 1960: 327-329 (descr., illustr., key).

Type locality. – SRI LANKA: Sabaragabuwa.

Type material examined. – Holotype, ♂ apt., SRI LANKA: Sabaragabuwa Prov., Kitulgala, 12.iv.1927., leg. G.M. Henry (BMNH). Paratypes, 3 ♀ apt., same locality data as holotype (BMNH).

Other material examined. – SRI LANKA: 3♂ 2♀ apt., Sabaragabuwa Prov., Kitulgayala, Dec., 1934 (SEMC); 4♂ 3♀ apt., Sabaragabuwa Prov., 57th mi. Kitulgayala, 23.vii.1966, leg. Karunaratne (JTPC); 3♂ 3♀ Central Prov., 6.-7.viii.1966, leg. P.B. Karunaratne (JTPC, NHMW); 2♂ 3♀ apt., 1 larva, Central Prov., Noari Estate, Noari, 10.vi.1966, leg. D.N. Bartholomaeusz (JTPC, PPCC); 7♂ 6♀ apt., 1♀ macr., Southern Prov., Homadola, Udugama, 2.vi.1966, leg. Karunaratne (SEMC, NHMW, JTPC); (Prov.?): 2♂ 1♀ apt., Pitamba, Ela., 26.i.1958, leg. K.L.A. Perera (SEMC).



Figs. 54-59.

54, *Ventidius henryi*, holotype, dorsal view of apterous male (legs removed), length 2.44 mm. — 55, *Ventidius henryi* dorsal view of macropterous female (appendages removed). — 56, 57, Macropterous pronotum. — 56, *V. polhemorum*; 57, *V. weneri*. — 58, *V. hungerfordi*, dorsal view of right fore wing (after Lansbury 1990). — 59, *V. modularis* (female), ventral view of abdominal segments.

Redescription

Dimensions. — Apterous form, length 2.46 (♂), 2.70 (♀), width 1.64 (♂), 1.84 (♀), width of head 1.04 (♂), 1.08 (♀).

Colour (fig. 54). — Whole body predominantly dark dorsally, with yellowish marks. Eyes blackish. Interoculus dark from dorsal view, with a thick M-shaped yellowish mark at its posterior margin, along inner margin of eye with a dark stripe which is connected with anterior margin of pronotum. Male antennal segments blackish except at basal 1/3 of segment 1. Pronotum blackish, posterolateral angle with a very small and indistinct yellowish mark. Mesonotum with broad dark lateral stripes, which are confluent with the lateral black stripe of metanotum. Metan-

otum dark laterally and a triangular dark mark basomedially which reaches its anterior margin. Mesopleura yellowish with a longitudinal stripe at anterior half (figs. 67-69); posterior margin of metapleura dark; metacetabula black with central yellowish mark (figs. 75, 76). Fore leg totally black (fig. 88). Middle and hind legs dark. Tergites 1-3 blackish, 4 blackish with a small obscure yellowish mark in the middle, 5-6 yellowish, 7-8 dark. Laterotergites and connexiva 1-4 blackish, 5-7 yellowish in male, predominantly yellowish with dark margins in female. Venter yellowish, male segment 8 ventrally darker.

Pilosity. — Inner surface of antennal segment 1 with 4 subbasal, and 1 subdistal long spines, along ventral surface of segments 2-4 clothed with usual pubes-

cence and longer setae; from distal half of segment 1, through all segments with dark fine hair fringe. Dorsum and pleura bearing dark and golden pubescence. Long stiff bristles scattered along middle and hind legs, tibiae with shorter stiff bristles. Venter clothed by golden pubescence, on genital segments the pilosity slightly longer and denser.

Structural characters. – Interoculus broader than width of an eye, 0.42 : 0.34 in males, 0.45 : 0.36 in females. Antennae moderately strong in male, segment 2 roughly of same length as segment 3 in male, shorter than segment 3 in females (measurements see table 1) (fig. 60). Pronotum not bulbous, mesonotum swollen dorsally, its lateral width 1.08 (♂), 1.30 (♀). Intersegmental suture between meso- and metanotum faint to obscure. Metanotum somewhat declivent. Lower half of hind margin of metacetabula obtusely triangular (figs. 75, 76). Metasternal tubercle not prominent in male. Anterior margin of abdominal tergite 1 obscure; anterior margins of tergites 2 and 3 faint, obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes.

Male terminalia. – Parameres (fig. 96) symmetrical, straight, bar-shaped with blunt apex; slightly extending beyond genital segments. Endosoma (fig. 114): dorsal sclerite long and recurved proximally, ventral sclerites long, lateral sclerites straight, hooked at apical end and broadened at distal end, second lateral sclerites long and thin, third lateral sclerites curved.

Female terminalia. – Abdominal sternite 7 large, broadly elevated medially, posterior margin slightly concave forward.

Macropterous form. – As apterous form except the apex of pronotum pointed (measurements see table 3); length of fore wings from humeri to apex 2.00. colour pattern of pronotum (fig. 55) black with two small roundish yellowish blotches. Wings anteriorly black with fine pubescence and with dense longer black hairs. Posterior membranous part of wings dark brown.

Distribution (map 2). – Sri Lanka: Sabaragabuwa, Central Prov., Southern Prov., Pitamba (Prov.?).

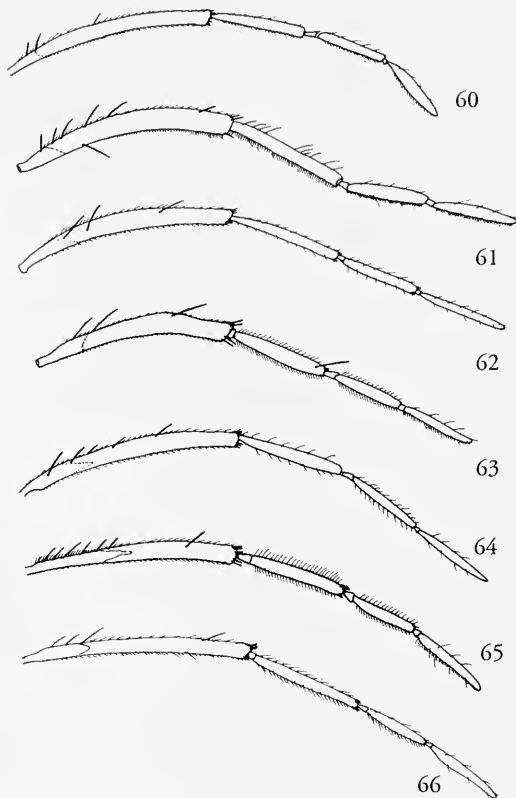
Comparative notes. – *Ventidius henryi* differs from all other species of the *V. modulatus*-group by much darker colouration (e.g. the black pronotum and completely black fore leg) and very different shape of paramere which is bar-shaped and not broadened in distal part.

7. *Ventidius* (s. str.) *hungerfordi* Cheng

(figs. 58, 61, 62, 77–80, 89, 90, 97, 115, 123, 124, map 2)

Ventidius hungerfordi Cheng, 1965:158–159, 163 (descr., illustr. & key); Kovac & Yang 1989: 285 (rec.).

Type locality. – MALAYSIA: Johor.



Figs. 60–66. Dorsal view of male right antennae. – 60, *Ventidius henryi*; 61, *V. hungerfordi*, apterous; 62, same species, macropterous; 63, *V. polhemorum*; 64, *V. wernerii*; 65, *V. pilosus*; 66, *V. modulatus*.

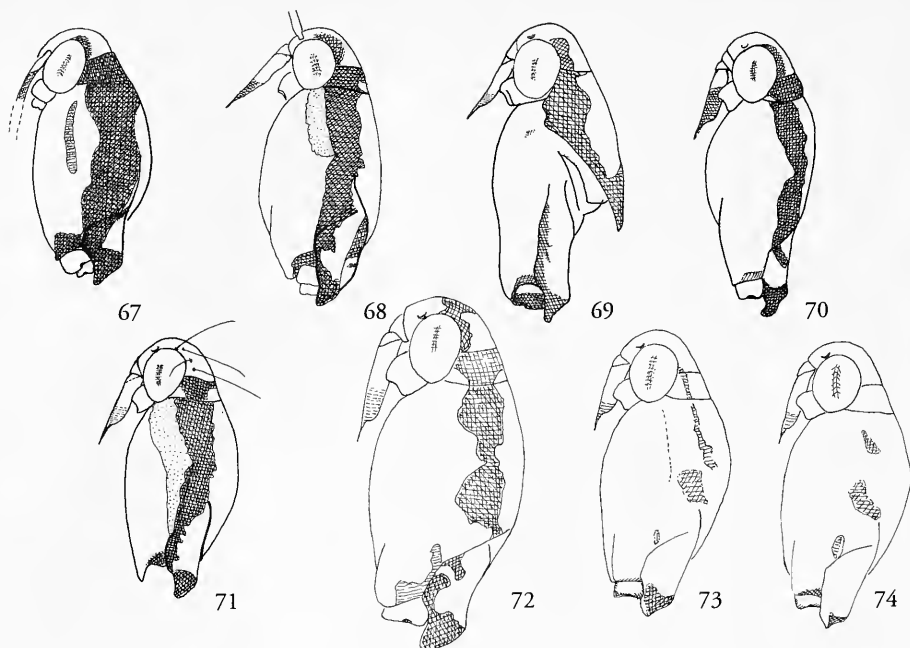
Ventidius wallacei Lansbury, 1988: 61–65 (synonym, descr., illustr.). Syn. n.

Type locality. – MALAYSIA: Selangor, Johor.

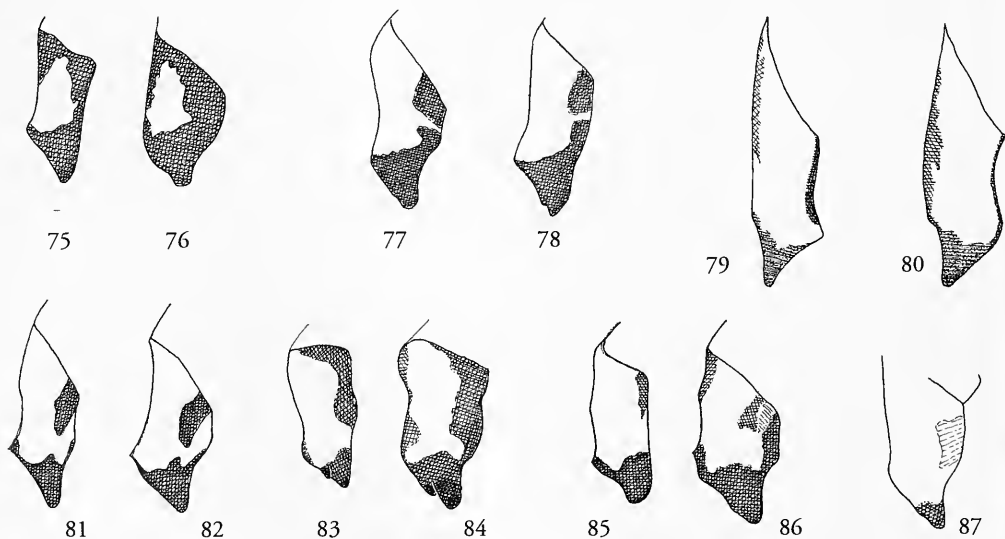
Type material examined. – *Ventidius hungerfordi*: Holotype ♂, apt., MALAYSIA: Selangor, Ampang, Sungai Kongsai Lapan (3°10' N., 101°46'30" E.), 2000 ft., 13.iii.1964, leg. L. Cheng (BMNH); Paratypes: 1 ♂ apt., same locality data, ZRCS 6.998 (ZRCS); 1 ♂ apt., Johor, stream at 48th mile, Mersing-Kluang Road, leg. C.H. Fernando, ZRCS 6.997 (ZRCS); 1 ♀ apt., Johor, Sungai Kayu Ara, 5.x.1964, leg. L. Cheng (BMNH).

Ventidius wallacei: Holotype ♂, macr., MALAYSIA: Mt. Ophir [= Gunong Ledang, Johor; Yang, pers. comm.] (A.R. Wallace) Westwood Coll. Oxford (OUMC).

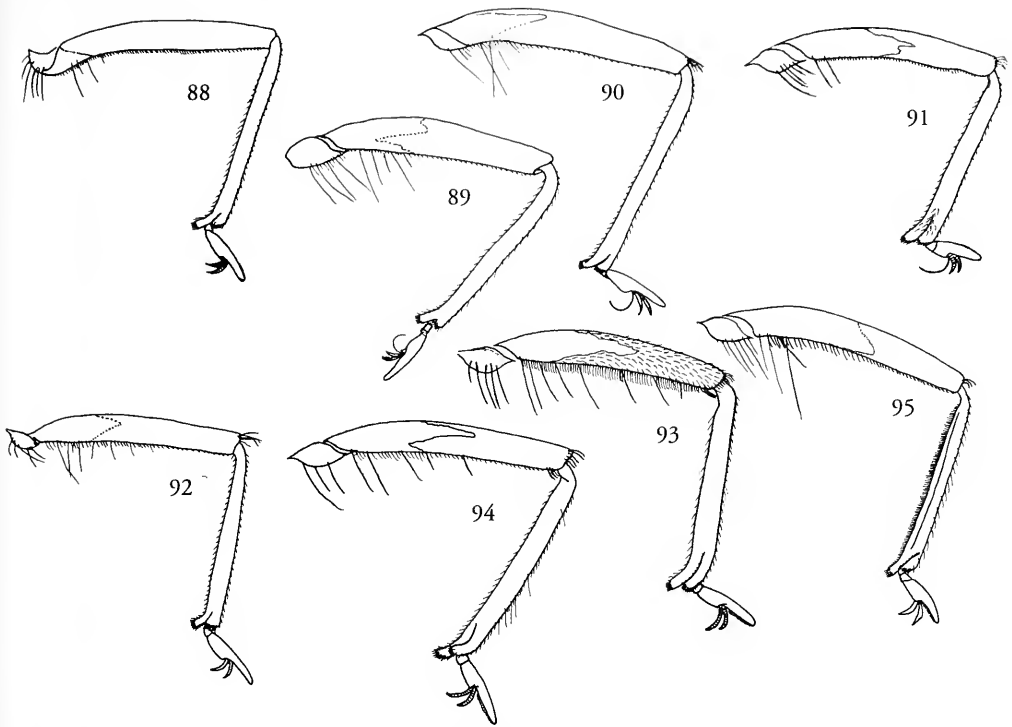
Other material examined. – THAILAND: 2 ♂ 4 ♀ apt., Kanchanaburi, Khao Phang waterfall, 70 km NW Kanchanaburi, 10.ix.1991, leg. P. Nielsen (ZMUC, NHMW); 1 ♀ apt., Kanchanaburi, Sai Yok, waterfall, 21–22.xii.1981, leg. N.M. Andersen (ZMUC); w. MALAYSIA: 7 ♂ 6 ♀ apt., 1 ♀ macr., Johor, Panti, stream, 20.ix.1990, leg. C.M. Yang & H.K. Lua, Y29b (ZRCS, NHMW); 3 ♂ 7 ♀ apt., Johor, same locality data, Y29c



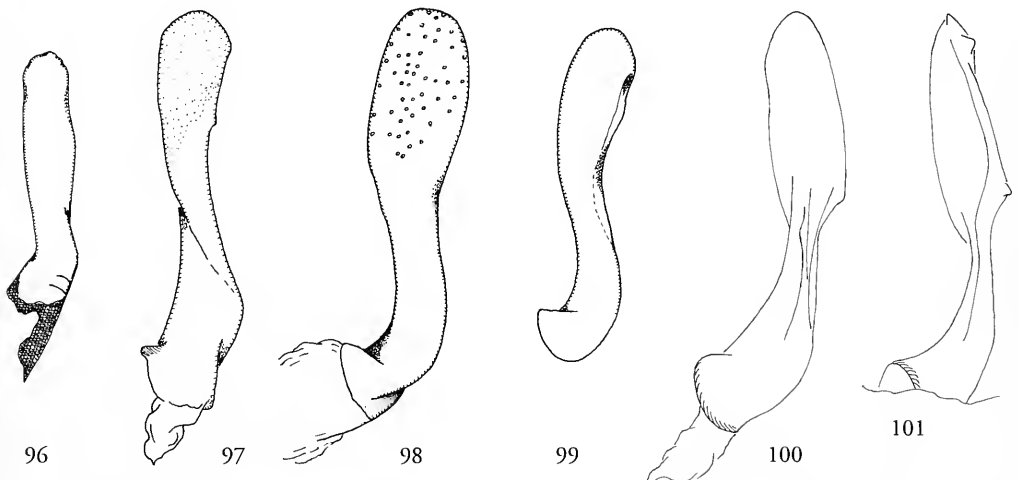
Figs. 67-74. Lateral view of apterous male, showing the colour pattern of pleura. – 67, 68, *Ventidius henryi*, apterous; 69, same species, macropterous; 70, *V. polhemorum*; 71, *V. werner*; 72, *V. pilosus*; 73-74, *V. modulatus* (lectotype).



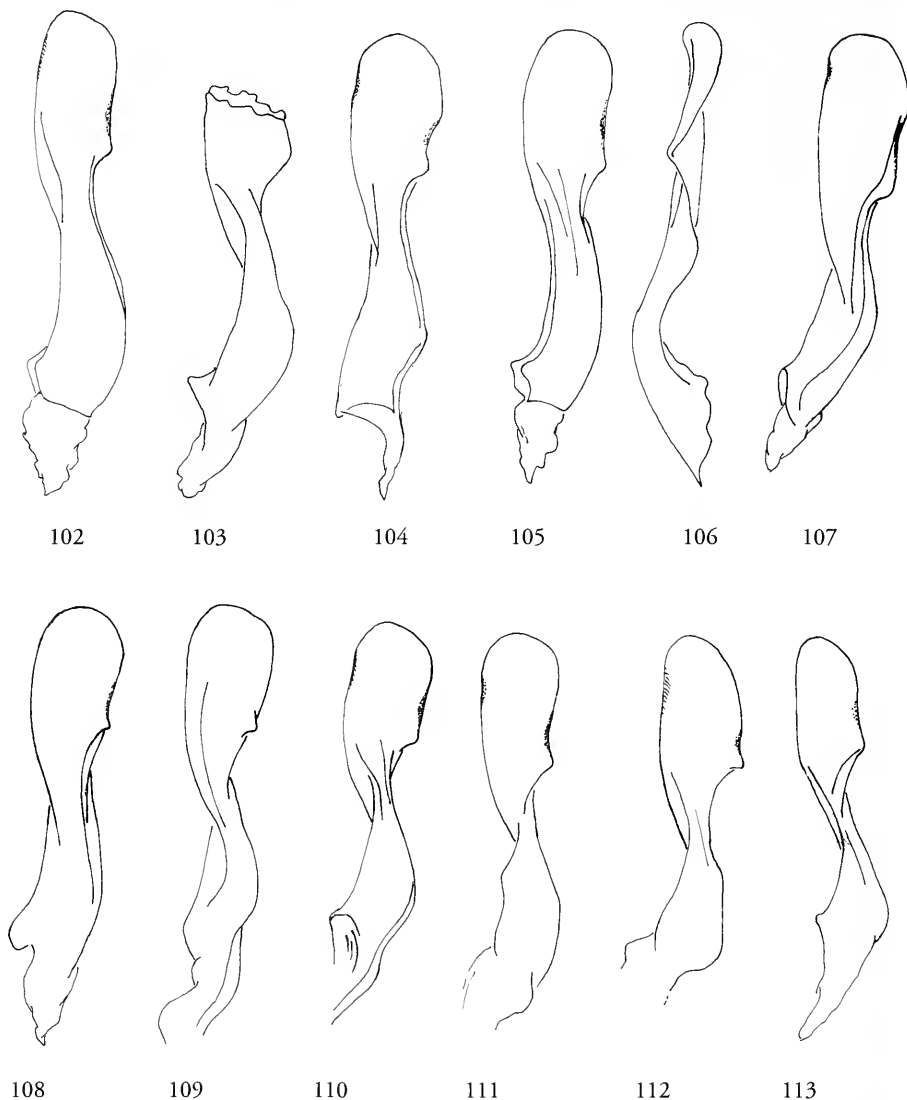
Figs. 75-87. Right metacubula of male; odd numbers (except 87): dorsal view, even numbers and 87: dorsolateral view. – 75, 76, *Ventidius henryi*; 77, 78, *V. hungerfordi*; 79, 80, same species, macropterous; 81, 82, *V. polhemorum*; 83, 84, *V. werner*; 85, 86, *V. pilosus*; 87, *V. modulatus* (lectotype).



Figs. 88-95. Dorsal view of male right fore legs. — 88, *Ventidius henryi*; 89, *V. hungerfordi*; 90, same species, macropterous; 91, *V. polhemorum*; 92, *V. wernerii*; 93, *V. pilosus* (male); 94, same species, female; 95, *V. modulatus* (lectotype).



Figs. 96-100. External view of left paramere. — 96, *Ventidius henryi*; 97, *V. hungerfordi*; 98, *V. polhemorum*; 99, *V. wernerii*; 100, *V. pilosus*; 101, *V. pilosus*, lateroventral view of right paramere.



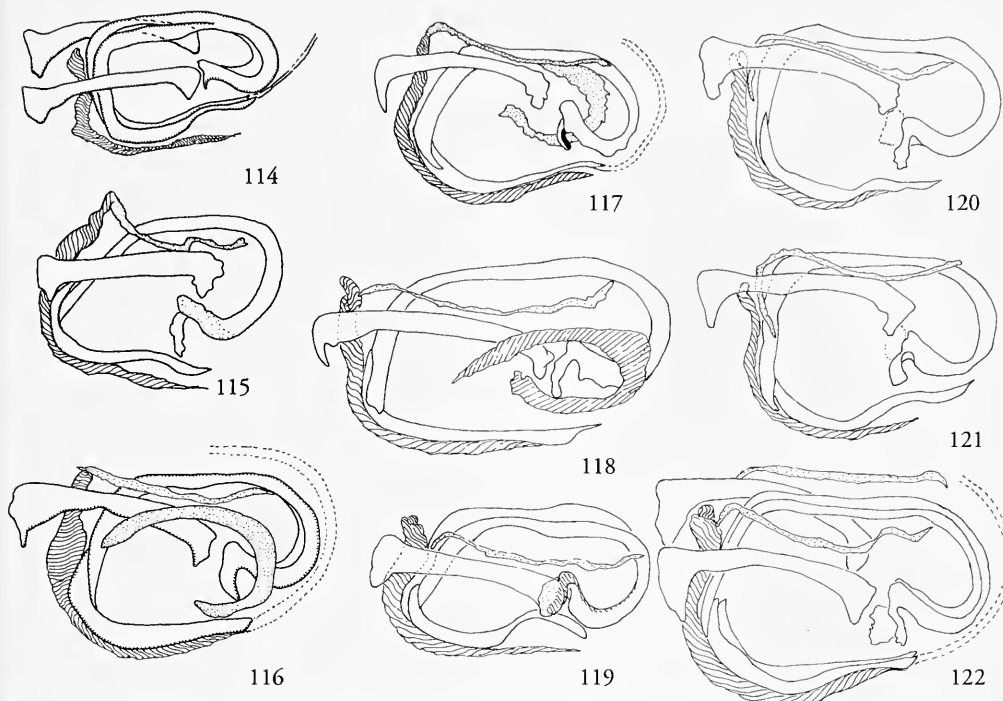
Figs. 102-113. – *Ventidius modulatus*, variation in parameres: external view of left paramere and dorsal view of right paramere (106). – 102, lectotype (Java); 103, holotype of *V. chinai* (Selangor); 104, paratype of *V. pubescens* (Johor); 105, from Sumatra; 106, from Sumatra; 107-113, from Thailand: 107, Chiang Mai (Doi Inthanon); 108, Ubon; 109, Chiang Rai (Fang); 110, Kanchanaburi; 111, Khon Kaen; 112, Chiang Mai (Hui Hong Krei); 113, Petchabun.

(ZRCS, PPCC); 2♂ 4♀, Johor, Kota Tinggi waterfall, 16 km N of Kota Tinggi, 60 m, 15.x.1986, CL 2217, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 1♀ apt., Johor, Kota Tinggi, waterfall, 25.ix.1993, Y838, leg. K.L. Yeo (ZRCS); 1♂ 1♀ apt., Johor, S. Bong, 5.iv.1992, Y788L, leg. K.L. Yeo (ZRCS); 1♂ 1♀ apt., Johor, S. Anak, Jasin, 4.iv.1992, Y788, leg. K.L. Yeo (ZRCS); 1♂ macr., Perak, Inah Hill, stream nr. reservoir, 11.iii.1927, coll. Dover (BMNH); 10♀ apt., Kelantan, waterfall 10 km NW of Pasir Puteh, CL 2084, 21.viii.1985, leg.

J.T. & D.A. Polhemus (JTPC, NHMW); 1♀ apt., Gua Sungei, Baling Kedah, ex megaderma spasma medium Gerrid (6324), 2.v.1935 (FOG23280) (BIMC).

Redescription

Dimensions. – Body length 2.77 (♂), 2.60 (♀), width 1.75 (♂), 1.80 (♀), width of head 1.01 (♂), 1.10 (♀).



Figs. 114-122. Lateral view of endosoma sclerites. – 114, *Ventidius henryi*; 115, *V. hungerfordi*; 116, *V. polhemorum*; 117, *V. wernerii*; 118, *V. pilosus*; 119-122, *V. modulatus*: 119, lectotype (Java); 120, paratype of *V. pubescens*; 121, From Thailand (Doi Inthanon); 122, holotype of *V. chinai*.

Colour (fig. 123). – Whole body prominently yellowish, dorsal ground colour yellowish with distinct dark marks. Eye dark brown. Interoculus pale, without distinct dark mark. Dark mark along inner margin of eye broad and reaching posterior margin of vertex. Antennal segments dark, except basal $\frac{1}{4}$ of segment 1. Pronotum blackish with a triangular yellowish mark medioposteriorly. Mesonotum yellowish dorsally, with dark lateral stripes. Metanotum yellowish with a small triangular black mark medioposteriorly. Mesopleura with a broad brownish stripe running through its length, lower part of metacetabula dark (figs. 77, 78). Fore leg dark with basal $\frac{1}{3}$ yellowish (figs. 89, 90). Middle and hind legs dark. Tergites 1-2 completely black, 3 prominently dark with a small faint yellowish spot in the middle, 4-6 yellowish but black laterally, 7 yellowish with dark posterior margin, posterior half of tergite 8 black. Laterotergites 1-2 completely black, 3 dark with small yellowish spot, 4-5 yellowish with dark margin, 6 yellowish. Connexiva 1-3 dark, the rest yellowish. Venter yellowish. Metasternum tubercle yellowish.

Pilosity. – Trichobothria on vertex conspicuous. Inner surface of antennal segment 1 with 4 subbasal,

and 1 subapical long spines; segments 2-4 with scattered dark short setae (fig. 61). Dorsum and pleura bearing longer dark setae. Pleura covered with blackish depressed longer silvery hairs. Venter clothed by golden pubescence. Stiff spines scattered along middle and hind legs.

Structural characters. – Interoculus longer than width of an eye, (0.41 : 0.36) in male, equal (0.40 : 0.40) in female. Antennae not modified, segment 2 longer than 3 in males (fig. 61), roughly of same length in females (measurements see table 1). Thorax not bulbous, mesonotum somewhat swollen, its lateral width 1.10 in both sexes. Intersegmental suture between meso- and metanotum weak but visible. Metanotum declivent. Lower part of metacetabulum obtusely triangular, but bilobate, the internal lobe smaller than external lobe and curved towards its body, therefore easily ignored (figs. 77, 78). Fore femur slender and not modified, claw rising from $\frac{1}{3}$ of segment 2 of fore tarsus. Anterior margin of abdominal tergite 1 distinct; anterior margins of tergites 2 and 3 obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes.

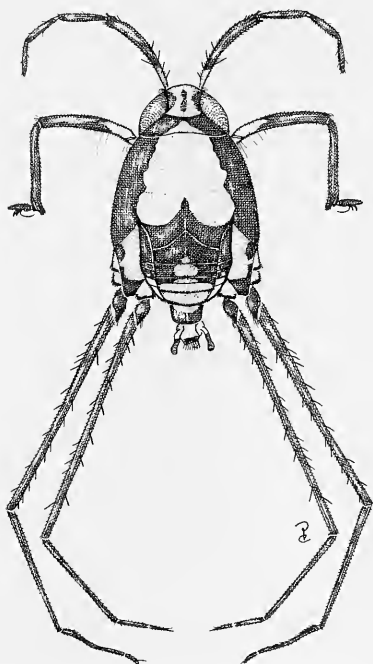


Fig. 123. *Ventidius* (s. str.) *hungerfordi*, holotype, apterous male, length 2.77 mm.

Male terminalia. — Parameres (fig. 97) symmetrical, slender and twisted in middle part, distinctly widened in apical part, usually with distinct small tubercle on external side of ventral margin, with rounded apex, extending beyond genital segments; Endosoma (fig. 115): dorsal sclerite long and recurved proximally, ventral sclerites long, lateral sclerites straight, proximal parts broadened and hooked, second lateral sclerites thin, apical sclerite indistinct.

Macropterous form. — We present a redescription of the macropterous holotype of *V. wallacei*.

Dimensions. — Body length 2.70, including wing 3.00, width 1.45, width of head 1.09.

Colour (fig. 124). — Whole body prominently yellowish, dorsal ground colour yellowish brown with distinct dark marks. Eye dark brown. Interoculus pale, without distinct dark mark. Dark mark along inner margin of eye reaching posterior margin of vertex. Antennal segments dark, except basal 1/5 of segment 1. Pronotum with blackish margins and with a large central irregularly shaped yellowish spot. Metanotum dark. Mesopleura yellowish, external angle of metacubacula dark. Fore leg dark with basal 1/3 yellowish. Middle and hind legs dark. Wings damaged, remnants dark rich brown, venation slightly darker, remnants of membranous part not differently

coloured from fore wings. Tergite 1 completely yellowish, tergite 2 dark, tergites 3-7 yellowish, posterior half of tergite 8 dark. Laterotergites yellowish. Connexiva 1-4 dark, 6-7 yellowish. Venter yellowish. Metasternum tubercle brownish.

Pilosity. — Inner surface of antennal segment 1 with 3 subbasal, and 1 subapical long spines; segments 2-4 with scattered dark short setae. Dorsum and pleura bearing dark pubescence. Pleura covered with blackish depressed hairs. Venter clothed by golden pubescence, especially on genital segments with longer pilosity. Stiff spines scattered along middle and hind legs. Basal part of middle and hind femur with two very long trichobothria-like setae on dorsal surface.

Structural characters. — Interoculus broader than width of an eye, 0.40 and 0.32 respectively. Antennae not modified, second segment longer than the third in males (fig. 62), measurements see table 1. Thorax not bulbous, lateral width of mesonotum 1.10. Mesosternal ridge almost reaching an imaginary line through faint brown spots anterior of lateral mesosternal ridges. Distal ridge slightly raised; lower part of metacubacula obtusely triangular (figs. 79, 80). Metasternal tubercle slightly prominent in male. Fore femur slender and not modified, claw rising from 1/3 of segment 2 of fore tarsus. Wing venation see figure 58. Anterior margin of abdominal tergite 1 distinct; anterior margins of tergites 2 and 3 obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes. Lateral tergite plate broad.

Male terminalia. — Parameres symmetrical, both pulpboard-shaped, with blunt apex; both extending beyond genital segments, internal side near lower margin with a very small but visible tooth-like tubercle, very easily ignored. Endosoma: dorsal sclerite long and recurved proximally, ventral sclerites long, lateral sclerites straight, proximal parts broadened and hooked, second lateral sclerites thin, apical sclerite indistinct.

Distribution (map 2). — Thailand: Kanchanaburi; Malaysia: Selangor, Johor, Kelantan, Perak.

Remarks. — *Ventidius wallacei* was described after a single macropterous male. The dense long pilosity of mesopleura and the thick antennal segment 1 remind immediately of *V. hungerfordi*. Lansbury (1988) compared *V. wallacei* with *V. hungerfordi* and states differences in colouration and parameres ('dark brown-black pigmentation of *wallacei* is much more extensive than that of *hungerfordi*; the paramere of the latter has a small tubercle on the rear margin, *wallacei* has the margins evenly rounded'). We cannot follow this opinion: The dark colouration corresponds well with a macropterous male of *V. hungerfordi* from Perak. After dissection of the paramere of the holotype of *V. wallacei*, we could detect a faint indication of a tu-

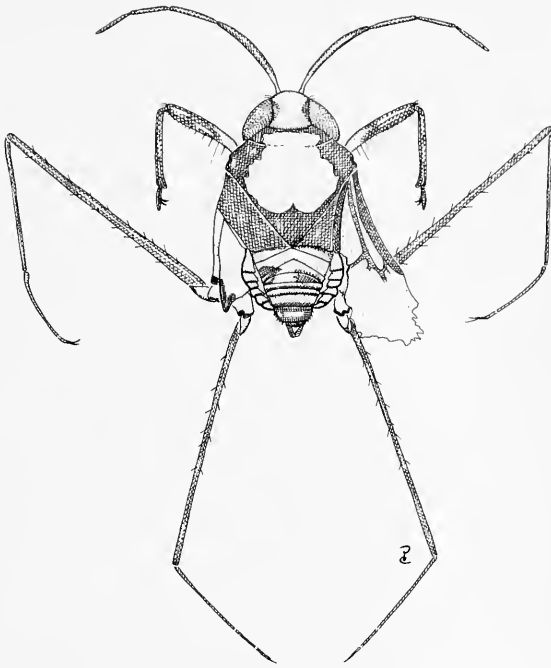


Fig. 124. *Ventidius* (s. str.) *hungerfordi*, macropterous male, length 3.0 mm (= *V. wallacei* Lansbury).

bercle on paramere from a certain direction of view; the tubercle is also weakly developed in *V. hungerfordi* (compared with *V. modulatus*). Although the paramere of *V. wallacei* is slightly more slender than is usual in *V. hungerfordi*, we regard this character as an individual variation and subsequently *V. wallacei* as a synonym of *V. hungerfordi*.

Comparative notes. – *Ventidius hungerfordi* seems to be closely related to the following three species (*V. polhemorum* sp. n., *V. werneri*, *V. pilosus* sp. n.) on the basis of the long pilosity on mesopleura and by a more or less enlarged antennal segment 1 in males (compared with that in *V. modulatus*). It can be separated from all of these species by the more distinct tubercle on the ventral external face of the paramere, which is lacking or very reduced in the other three species. *Ventidius hungerfordi* can be separated from *V. modulatus* (which is the only sympatric species of this group) also by a flatter body in both sexes.

8. *Ventidius* (s. str.) *polhemorum* sp. n.
(figs. 56, 63, 70, 81, 82, 91, 98, 116, 125, map 2)

Type locality. – MALAYSIA: Sabah.

Type material. – Holotype ♂, apt., allotype ♀, apt., MALAYSIA: Sabah, Borneo, 34 km NE of Kota Belud, CL 2033, 5. VIII.1985, leg. J.T. & D.A. Polhemus (JTPC). – Paratypes: 9 ♂ 26 ♀ apt., 2 ♂ 4 ♀ macr., same

locality data as holotype (JTPC, NHMW, PPCC); 24 ♂ 52 ♀ apt., 2 ♂ 3 ♀ macr., Sabah, Borneo, 40 km NE of Kota Belud, CL 2032, 5.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW, PPCC); 3 ♂ 1 ♀ apt., Sabah, Borneo, stream 5 km S of Poring Hot Springs, CL 2024, 2.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); 1 ♂ apt., Sabah, (North Borneo, SE), Forest Camp, 19 km N of Kalabakan, 12.xi.1962, light trap [?], leg. Y. Hiyashima (BIMC); 1 ♀ macr., same locality data, 13.xi.1962 (BIMC); 4 ♀ apt., Sabah, Danum Valley, Sapat Kalisan, 12.2.1997, leg. H. Zettel (15) (UMSM, NHMW); 1 ♂ 3 ♀ apt., Sabah, Danum Valley, Palum Tambun, 12.2.1997, leg. Zettel et al. (P83 & P90) (UMSM, NHMW, SPCM); 3 ♂ 3 ♀ apt., 1 ♀ macr., Sarawak (Borneo), 8 km S of Tebakang, stream disappearing into cave, CL 2046, 9.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 1 ♂ apt. Sarawak, Sameran River, 2 km W of Tube, CL 2047, 19.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); 1 ♂ 2 ♀ apt., 1 ♀ macr., Sarawak (Borneo), 4 km S Tebakang, 19.viii.1985, CL 2044, leg. J.T. & D.A. Polhemus (JTPC).

Etymology. – The species is named after Dr. J.T. Polhemus (Englewood) and Dr. D.A. Polhemus (Washington), for their distinguished achievements in the aquatic and semiaquatic Hemiptera fauna of the world, and for their generous offering of material deposited in the JTPC and BIMC collections for our study.

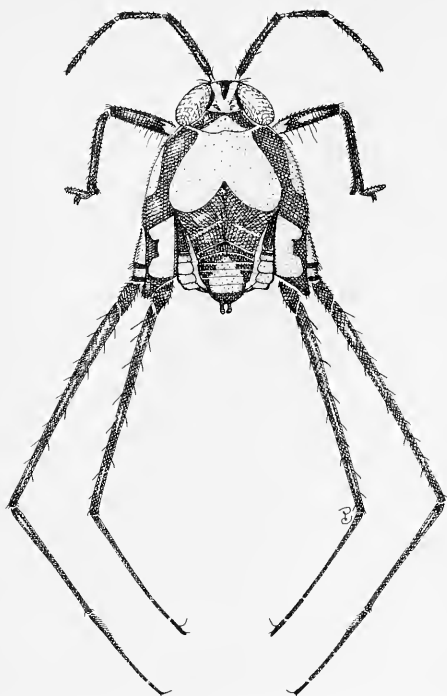


Fig. 125. *Ventidius* (s. str.) *polhemorum*, paratype, apterous male, length 2.78 mm.

Description

Dimensions. — Body length 2.78 (♂), 2.89 (♀), width 1.73 (♂), 1.95 (♀), width of head 1.10 (♂), 1.10 (♀).

Colour (fig. 125). — Whole body prominently yellowish, dorsal ground colour yellowish with distinct dark marks. Eye dark brown. Interoculus pale, central part with darker pilosity. Dark mark along inner margin of eye broad and reaching posterior margin of vertex. Antennal segments dark, except basal ¼ of segment 1. Pronotum yellowish with dark lateral mark. Mesonotum yellowish dorsally, with dark lateral stripe. Metanotum yellowish with a small triangular black mark medioposteriorly and dark lateral stripes. Mesopleura yellowish, lower part and external margin of metacetabula dark (fig. 70). Fore leg dark with basal half yellowish (fig. 91). Middle and hind legs dark. Tergites 1-2 completely black, 3 prominently dark with a small faint yellowish spot in the middle, 4 black with a big yellowish mark in the middle, 5-6 yellowish but black laterally, tergite 7 yellowish with dark posterior margin, posterior half of tergite 8 black. Laterotergites 1-2 completely black, 3-7 yellowish. Connexiva slightly darkened. Venter yellowish. Metasternum tubercle yellowish.

Pilosity. — As a whole, body with long, more promi-

nent pilosity. Inner surface of antennal segment 1 with 4 subbasal and 1 subapical spine, and 2-3 long spines scattered; segments 2-4 with scattered dark short setae, and especially inner surface of segments 2-4 with fine hair fringe (fig. 63). Dorsum and pleura bearing dark setae, more conspicuous on pleura and metacetabula. Venter clothed by pale pubescence. Genital segments with longer and darker setae. Stiff spines scattered along middle and hind legs.

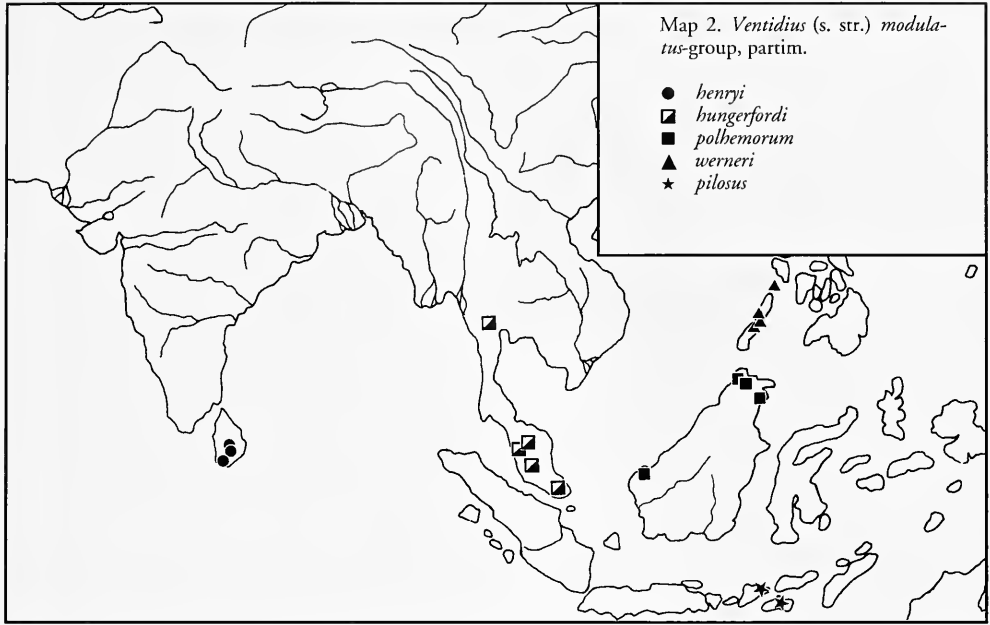
Structural characters. — Interoculus broader than width of an eye (0.46 : 0.39) in male, equal (0.40 : 0.40) in female. Antennae not modified, segment 2 longer than 3 in males (fig. 63), shorter than in females (measurements see table 1). Thorax not bulbous, mesonotum somewhat swollen, its lateral width 1.20 (♂), 1.23 (♀). Intersegmental suture between meso- and metanotum weak but visible, and marked with a fine brownish line laterally. Metanotum declivent. Lower part of metacetabula obtusely triangular, but bilobate in caudal view, the internal lobe much smaller than external lobe and slightly curved mediad (figs. 81, 82). Metasternal tubercle darkened. Fore femur slender and not modified, claw rising from ⅓ of segment 2 of fore tarsus. Anterior margin of abdominal tergite 1 faint; anterior margins of tergites 2 and 3 obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes.

Male terminalia. — Parameres (fig. 98) symmetrical, curved, broad in middle part, slightly widened apically, usually without any tubercle, in some specimens with a faint indication of a dimple, with rounded apex; extending beyond genital segments. Endosoma (fig. 116): dorsal sclerite long and recurved proximally, ventral sclerites long, lateral sclerite straight, broadened and hooked at two ends, second lateral sclerite thin, apical sclerite indistinct.

Macropterous form. — 1.40 mm long, maximum width 1.51 mm. colour pattern (fig. 56) of pronotum yellowish anteriorly and in the central area with two yellowish blotches, lateral and posterior margin blackish. Wings anteriorly blackish with fine pubescence and with scattered longer black hairs. Posterior membranous part of wings dark brown. The other morphological characters as apterous form except the apex of pronotum pointed (measurements see table 3); length of fore wings from humeri to apex 2.40 mm.

Distribution (map 2). — East Malaysia: Sabah, Sarawak.

Comparative notes. — This species is very similar to *V. hungerfordi* (Malaya), *V. werneri* (Philippines: Palawan), and *V. pilosus* sp. n. (Indonesia: Sumba) by colour pattern, conspicuous pilosity, and slightly bilobate lower structure of metacetabula. *Ventidius werneri* and *V. pilosus* sp. n. differ in males by a distinctly more slender antennal segment 1 and by differ-



ent shapes of parameres. *Ventidius hungerfordi*, which is similar in most characters can be distinguished by the paramere which in *V. hungerfordi* is strongly widened apically and usually with a distinct tubercle on the ventral external face, but in *V. polhemorum* sp. n. is less widened (because of the wide middle part) and usually without any tubercle.

9. *Ventidius* (s. str.) *weneri* Hungerford & Matsuda (figs. 57, 64, 71, 83, 84, 92, 99, 117, 126, map 2)

Ventidius weneri Hungerford & Matsuda 1960: 330-331 (descr., illustr., key).

Type locality. – PHILIPPINES: Palawan.

Type material examined. – Holotype ♂ apt., and allotype ♀ apt., PHILIPPINES: Palawan 'CNHM Philippines Zool. Exped. (1946-47). F.G. Werner, Puerto Princesa, Palawan Is. Sea Level, March (1947)' (CNHM).

Other material examined. – 5♂ 15♀, all apt., PHILIPPINES: Palawan, Sabang, 0-30 m, 27.iii.1994, leg. Zettel (52b) (NHMW, PCC); 1♂ 11♀ apt., 1♂ macr., Palawan, 9 km W Puerto, Prince, Iwahig, Balsahan riv., leg. Zettel, 24.iii.1994 (48, 60) (NHMW, PCC); 2♀ apt., Palawan, Baccungan Creek, 18 km NW of Puerto Princesa, CL 2019, 28.vii.1985, leg. J.T. & D.A. Polhemus (JTPC); 12♂ 16♀ apt., Palawan, Apoapo Arawan River, 76 km S of Puerto Princesa, CL 2005, 25.vii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW, PCC); 6♂ 11♀ apt., Palawan, Taritien River, at Trident Mine, 7 km NW of Narra, CL 2011, 27.vii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 6♂ 18♀ apt., 1♀ macr., Palawan, Balsahan Riv., 20 km SW of Puerto Prince-

sa, CL 2014, 27.vii.1985, leg. J.T. & D.A. Polhemus (JTPC); 6♂ 10♀ apt., Palawan Pr., Busuanga Is., 13 rd.km WNW Coron, Balulu Falls, 24.2.1996, leg. H.Zettel (81) (ZCWA, GCLB, UPLB); 2♂ 1♀ macr., Palawan Pr., Busuanga Is., 5 km NW Coron, Mabintangan Riv., 25.-29.2.1996, leg. H. Zettel (82) (ZCWA).

Redescription

Dimensions. – apterous form, length 2.41 (♂), 2.50 (♀), width 1.66 (♂), 1.74 (♀), width of head 1.06 (♂), 1.04 (♀).

Colour (fig. 126). – Whole body prominently yellowish, with distinct dark marks. Eye dark brown or blackish. Interoculus pale, with one large more or less round dark mark, which stretches backwards into a short stripe at each external corner, in most cases very difficult to recognize as a clear shape; dark mark along inner margin of eye reaching posterior margin of vertex. Antennal segments black except basal ¼ of segment 1. Pronotum with very broad dark stripes so usually looking prominently dark, with a yellowish transverse band along posterior margin and one small yellowish spot at each latero-posterior angle. Mesonotum yellowish with dark lateral stripes. Metanotum yellowish with a triangular black mark at medio-posterior margin. Mesopleura with a broad brownish stripe, external angles of metacubula dark (figs. 71). Fore leg dark with less than basal half yellowish (fig. 92). Middle and hind legs dark. Tergites 1-3 completely dark, 4-5 dark, with trace of central light mark, 6-7 prominently yellowish, 8 prominently

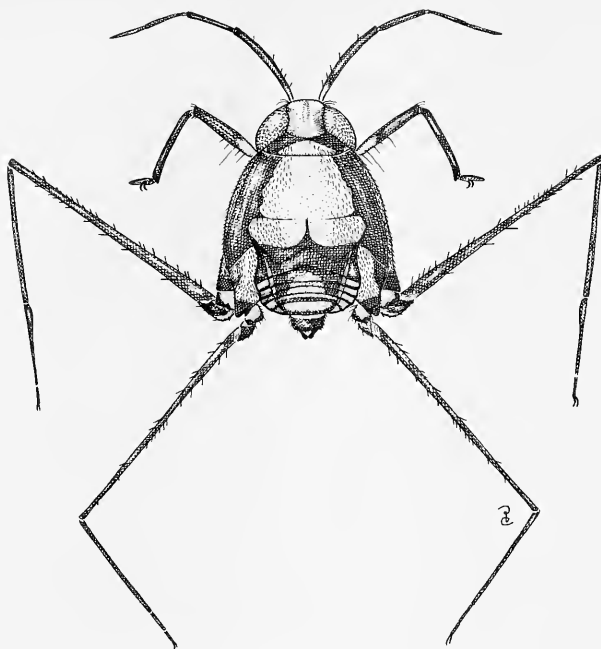


Fig. 126.

Ventidius (s. str.) *werneri*, apterous male, length 2.40 mm.

dark. Laterotergites 1-2 dark, 3-7 yellowish. Connexiva 1-5 dark, 6-7 yellowish. Venter yellowish.

Pilosity. — As a whole, body with longer, more prominent pilosity. Trichobothria on vertex conspicuous. Inner surface of antennal segment 1 with 4 sub-basal and 1 subapical long spines, dorsal surface with 1 subbasal spine; through basal half of segment 1 to apical half of segment 4 with fine hair fringe, especially segments 2-3 more distinct, segments 2-4 with scattered dark short setae (fig. 64). Dorsum and pleura bearing long, dark pubescence, more distinct than usually. Venter clothed by golden pubescence, especially on mesosternum denser. Fore trochanter and femur with dark longer trichobothria setae; Inner surface of fore femur and tibia with dark fine hair fringe. Longer stiff spines scattered along middle and hind legs. Basal part of middle and hind femora with a very long trichobothria-like seta on dorsal surface.

Structural characters. — Interoculus broader than width of an eye, 0.40 : 0.38 in male, 0.41 : 0.37 in female. Antennae not modified, segment 2 longer than 3 in males (fig. 64), shorter than 3 in females (measurements see table 1). Thorax bulbous, mesonotum somewhat swollen, its lateral width 0.91 (♂), 0.95 (♀). Intersegmental suture between meso- and metanotum weak but visible. Metanotum strongly declivent. Lower part of metacetaula obtusely triangular, but bilobate in caudal view, internal lobe smaller than external lobe and curved towards its body, therefore easily ignored (figs. 83, 84). Metasternal tubercle slightly

prominent in male. Fore femur slender and not modified, claw rising from $\frac{1}{3}$ of segment 2 of fore tarsus. Anterior margin of abdominal tergite 1 distinct; anterior margins of tergites 2 and 3 obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes.

Male terminalia. — Parameres (fig. 99) symmetrical, slightly curved, not twisted halfway its length, very slender in middle of its length, apically distinctly widened, without or with a very faint indication of a tubercle, with rounded apex; extending beyond genital segments. Endosoma (fig. 117): dorsal sclerite long and recurved proximally, ventral sclerite long, lateral sclerites straight, hooked at two ends, second lateral sclerites thin, apical sclerite indistinct.

Female terminalia. — Abdominal sternite 7 large, posterior margin smooth, concave forwards.

Macropterous form. — As apterous form except the apex of pronotum pointed (measurements see table 3); length of fore wings from humeri to apex 2.45. colour pattern of pronotum (fig. 57) black with two irregular yellowish blotches. Wings anteriorly black with fine pubescence and with scattered longer black hairs. Posterior membranous part of wings dark brown.

Distribution (map 2). — The Philippines: Palawan Prov.: Palawan Island, Busuanga Island.

Comparative notes. — This species is very similar to *V. hungerfordi*, *V. polhemorum* sp. n., and *V. pilosus* sp. n. For distinguishing characters see under the comparative notes of these species.

10. *Ventidius* (s. str.) *pilosus* sp. n.
(figs. 65, 72, 85, 86, 93, 94, 100, 101, 118, 127, map 2)

Type locality. — INDONESIA: Sumba.

Type material. — Holotype, ♂, apt., INDONESIA: Sumba, Nusa Tenggara Timur Prov., Patawang, 55 km E of Waingapu, 15.ix.1991, CL 2603, leg. D.A. & J.T. Polhemus (JTPC). — Paratypes, 23 ♂ 20 ♀, apt., 1 ♂ 2 ♀ macr., same locality data as holotype (JTPC, NHMW, PCC); 5 ♂ 3 ♀ apt., Sumba, Nusa Tenggara Timur Prov., spring and stream 10 km S of Waingapu, 180 m, 13.ix.1991, CL 2597, leg. D.A. & J.T. Polhemus (JTPC); 53 ♂ 101 ♀ apt., Sumba, Nusa Tenggara Timur Prov., Mata River, 49 km E of Waingapu, 15 m, 15.ix.1991, CL 2604, leg. D.A. & J.T. Polhemus (JTPC, PCC, NHMW); 41 ♂ 43 ♀ apt., Sumbawa, Nusa Tenggara Barat Prov., Bela River, 28 km SW Bima, 100 m, CL 2172, 19.x.1985, leg. J.T. & D.A. Polhemus (JTPC, PCC, NHMW).

Etymology. — Species name refers to the conspicuous pilosity of its body, especially the longer hair fringe on the ventral surface of fore femur in both sexes.

Description

Dimensions. — Apterous form, length 2.60 (♂), 3.06 (♀), width 1.82 (♂), 2.20 (♀), width of head 1.15 (♂), 1.26 (♀).

Colour (fig. 127). — Whole body prominently yellowish, with distinct dark marks. Eye dark brown or blackish. Interoculus pale, with three longitudinal brownish marks, one in middle and two along inner margin of eyes which stretch backwards to the hind margin of vertex. Antennal segments black except basal 2/5 of segment 1. Pronotum with very broad dark stripes so usually appearing prominently dark, with a yellowish triangular mark along posterior margin and one small yellowish spot at each latero-posterior angle. Mesonotum yellowish with dark lateral stripes. Metanotum yellowish with a small triangular black mark at medio-posterior margin and two large square dark marks laterally. Mesopleura totally yellowish (fig. 72). Metacetabula with posterior external angles dark and brownish in anterior external part (figs. 85, 86). Fore leg dark with basal half of fore femur yellowish (fig. 93). Middle and hind legs dark. Tergite 1 completely dark or with two vague yellowish marks laterally, 2-5 dark with triangular central yellowish marks, 6-7 yellowish, 8 dark. Laterotergites in some specimens totally yellowish, in some specimens tergites 1-3 dark, 4 prominently dark with central yellowish mark, 5-7 yellowish. Connexiva 1-5 dark, 6-7 yellowish. Venter yellowish.

Pilosity. — As a whole, the body with more prominently pilosity. Trichobothria on vertex conspicuous. Inner surface of antennal segment 1 with 6 subbasal,

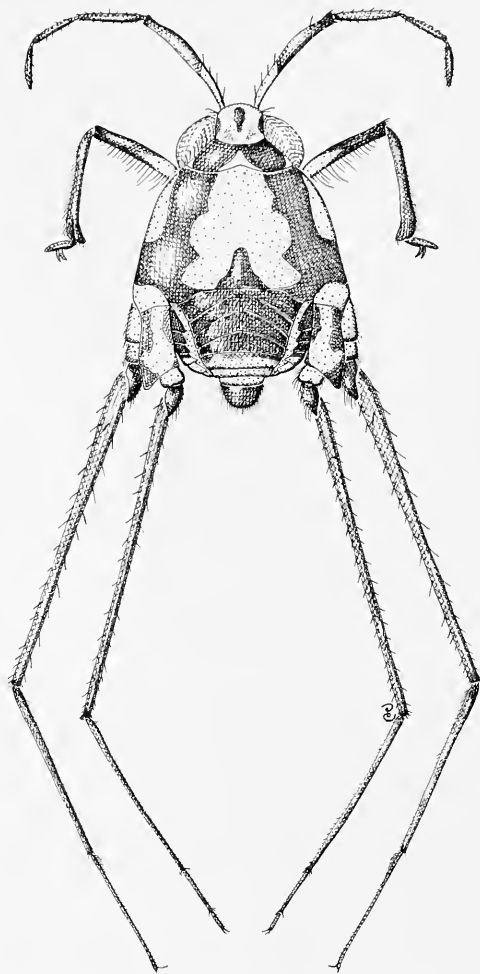


Fig. 127. *Ventidius* (s. str.) *pilosus*, holotype, apterous male, length 2.60 mm.

and 1 subapical long spines; through basal half of segment 1 to apical half of segment 4 with dark fine hair fringe, and with scattered dark short setae (fig. 65). Dorsum and pleura bearing dark pubescence, more conspicuous than usually in the genus. Venter clothed by golden pubescence. Ventral face of fore trochanter and femur with dark long trichobothrial setae; in both sexes ventral surface of fore femur with dark long hair fringe. Longer stiff spines scattered along middle and hind legs.

Structural characters. — Interoculus broader than width of an eye, 0.49 : 0.40 in both sexes. Antennal segment 1 stout but not as broad as in *V. hungerfordi*, segment 2 longer than segment 3 in both sexes (fig.

65), segment 3 shorter than 4 in male (measurements see table 1). Mesonotum somewhat swollen, its lateral width 1.11 (♂), 1.27 (♀). Intersegmental suture between meso- and metanotum weak but visible. Metanotum declivent. Posterior part of metacetabula obtusely triangular. (figs. 85, 86). Fore femur slender and not modified, claw rising from 1/3 of segment 2 of fore tarsus (figs. 93, 94). Anterior margin of abdominal tergite 1 distinct; anterior margins of tergites 2 and 3 obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes.

Male terminalia. — Parameres (fig. 100, 101) symmetrical, slightly curved, distinctly twisted halfway its length, with slender middle part, apical part distinctly widened, with a faint indication of a tubercle on ventral external face, apex rounded, extending beyond genital segments. Endosoma (fig. 118): dorsal sclerite long and recurved proximally, ventral sclerite long, lateral sclerite straight, hooked at two ends, second lateral sclerites thin, with third lateral sclerites, apical sclerite indistinct.

Female terminalia. — Abdominal sternite 7 large, posterior margin smooth, slightly concave anteriorly.

Macropterous form. — As apterous form except the apex of pronotum pointed (measurements see table 3); colour pattern of pronotum: black with yellowish median line and two irregular yellowish blotches. Wings anteriorly black with fine pubescence. Posterior membranous part of wings dark brown. length of fore wings from humeri to apex 2.45 mm.

Distribution (map 2). — Indonesia: Nusa Tenggara Timur Prov. (Sumba Isl.), Nusa Tenggara Barat Prov. (Sumbawa Isl.).

Comparative notes. — This species is very similar to *V. hungerfordi*, *V. polhemorum* sp. n., and *V. werneri*, but *V. hungerfordi* and *V. polhemorum* sp. n. are easy to distinguish by the stouter antennal segment 1 of males and by the shapes of parameres. The most similar species is *V. werneri* from Philippines (Palawan), which has a similar slender antennal segment 1 and slender parameres, but the paramere of *V. pilosus* sp. n. is more twisted, whereas that of *V. werneri* is nearly straight; further *V. pilosus* sp. n. is larger in body size and length of middle and hind femora (comp. table 2), has a denser pilosity of fore femora in both sexes and a longer antennal segment 2 (compared with segment 3, see Tab. 1), and differs in colouration of the abdomen.

11. *Ventidius* (s. str.) *modulatus* Lundblad (figs. 59, 66, 73, 74, 87, 95, 102-113, 119-122, 128, map 3)

Ventidius modulatus Lundblad, 1933: 339-401 (descr., illustr., tr.); Hungerford & Matsuda 1960: 329 (descr., illustr., key); Cheng 1965: 162-163 (descr., illustr., key); Kovac

& Yang 1989: 285 (rec.); Yang & Kovac 1995: 293 (rec.); Zettel & Chen 1996: 152, 180 (list, rec.); Hanboonsong et al. 1996: 24 (rec.).

Ventidius chinai Hungerford & Matsuda, 1960: 331-332, 336 (descr., illustr., key) Syn. n.

Ventidius pubescens Cheng, 1965: 160-161, 163 (descr., illustr., key) Syn. n.

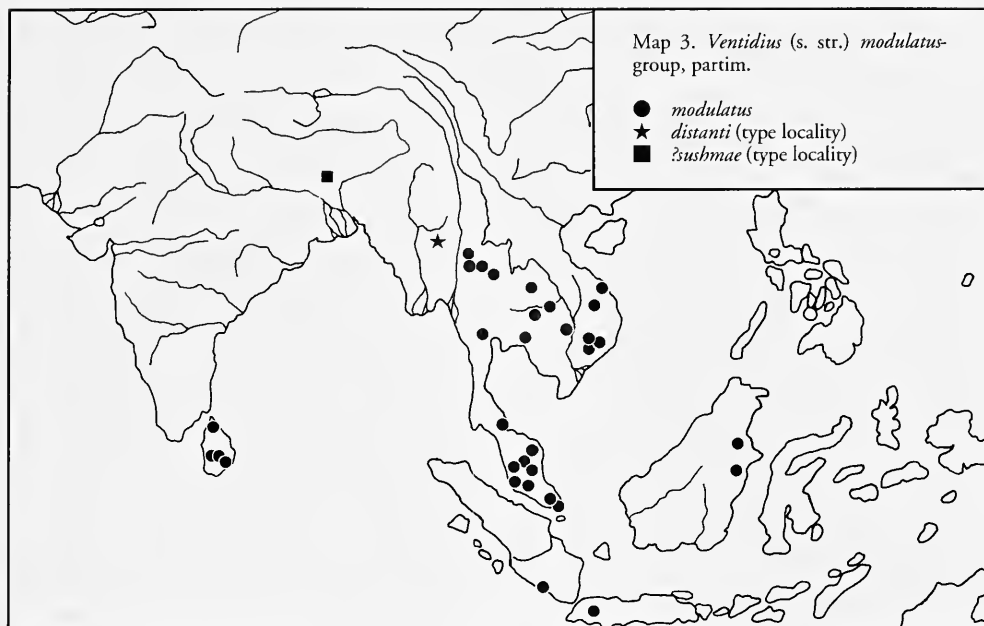
Type locality. — INDONESIA: Western Java.

Type material examined. — *Ventidius modulatus*: Lectotype (present designation) ♂ apt., INDONESIA: 'Westjava, Stausee Tjigombong, South of Buitenzorg, 500 m above sea level, 17.ix.1928' (SMNH); paralectotypes: 2 ♂ apt., from the same locality (SMNH).

Ventidius chinai: Holotype ♂ apt., MALAYSIA: 'Malay Peninsula, Selangore, F.M.S. Kajang Sungai Lang, Feb. 12, 1927', 'C. Dover Coll., F.M.S. Museum' (antennal segments 3-4 and parts of legs missing) (BMNH); allotype ♀ apt., and paratypes 1 ♂ 1 ♀ apt from the same locality (genitalia of male missing) (BMNH).

Ventidius pubescens: Holotype ♂ apt., and allotype ♀ apt., MALAYSIA: Johor, Sungai Muar at Rompin, 14.iii.1963, leg. L. Cheng (BMNH); paratypes: 8 ♂ 3 ♀ apt., same locality (BMNH, ZRCS).

Other material examined. — SRI LANKA: 1 ♀ apt., 1 ♂ macr., Northern Prov., 28 mi. Pullian-kulam Nedunkerni Rd., 1.-5.v.1966, slow stream, shady corners, leg. P.B. Karunaratne (JTPC); 2 ♂ 2 ♀ apt., Northern Prov., 127 mi. Madu Rd., 14.iv.1968, leg. P.B. Karunaratne (JTPC, NHMW); 2 ♂ 1 ♀ macr., North Western Prov., Giriulla 13.x.1957, leg. C.H. Fernando. (SEMC); 2 ♂ 2 ♀ Central Prov., Aruppola, Kandy, 25.vi.1966, edge of river Mahaveli, leg. P.B. Karunaratne (AMNH, JTPC, PPCC); 4 ♂ 5 ♀ apt., Central Prov., Katagastota, Kalugala, Pinga, Oya, 30.vii.1966, leg. P.B. Karunaratne (JTPC, NHMW); 1 ♀ apt., 2 ♀ macr., Uva Prov., Helagama, 500 ft., 7.-8.xii.1967, Okkampitiya, from Kumbukkan Oya, leg. P.B. Karunaratne (JTPC); 3 ♂ 3 ♀ apt., Uva Prov., Aluthnuwara, 29.viii.1967, leg. P.B. Karunaratne (JTPC, NHMW); 2 ♂ 2 ♀ apt., Uva Prov., Helagama, 500 ft., 7.-8.xii.1967, Meeminna, Hela Pool, at foot of hill, leg. P.B. Karunaratne (JTPC, PPCC); THAILAND: 9 ♂ 15 ♀ apt., Chiang Mai Prov., Doi Inthanon N.P., Mae Klang Falls, 4.xi.1995, leg. H. Zettel (6) (NHMW, PPCC, NCTN); 19 ♂ 24 ♀ apt., Chiang Mai Prov., Huai Hong Khrai, 30 km N. Chiang Mai, stream, 500 m, 31.xi.1994, leg. P.P. Chen & S. Wongsiri (PPCC, NCTN, NHMW); 22 ♂ 14 ♀ apt., Chiang Mai Prov., Fang Horticultural Station, ponds, 15.xi.1985, CL 2201, leg. J.T. & D.A. Polhemus (JTPC, PPCC, NHMW); 2 ♂ 1 ♀ macr., Chiang Mai Prov., 7 km NW of Fang, Horticultural Experimental Station, 30.x.-2.xi.1979, Zool. Mus. Copenhagen Exped. (ZMUC); 11 ♂ 10 ♀ apt., 4 ♂ 3 ♀ macr., Chiang Mai Prov., stream 10 km NW of Mae Rim, 19.xi.1985, CL 2204, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 1 ♂ 5 ♀ apt., Lampang Prov., Nam Mae Tha, 300 m, loc. 67, shallow river, 4.iii.1989, leg. M. Andersen & H. Read (ZMUC); 1 ♀ apt., Lampang, 7 km SW Sop Drop, Mae Nam Wang, 23.iii.1994, A-1041, leg. W.D. Shepard (NHMW); 1 ♂ 4 ♀ macr., Tak Prov., Sam Ngao, at Bhumiphol Dam, 6.-8.xi.1979, Zool. Mus. Copenhagen Exped. (ZMUC); 1 ♂ 2 ♀ Phitsanulok Prov., Subdiv. of Tung Saleangluang N.P., waterfall of Kaek riv., 17.xi.1994, leg. Chen & Piyapichart (PPCC); 1 ♂ apt., Phitsanulok Prov., Boi Waterfall, nr. Mae Nam, Khék River, 300 m, loc. 60, 2.iii.1989, leg. Mich. Andersen & H. Read (ZMUC); 3 ♂ 3 ♀ apt. Ubon Ratchan-



thani, Ban Tasala, Mae Kong River, 17. Nov. 1995, leg. Yupa Hanboonsong (NHMW); 1 ♂ apt., Ubon Ratchanthani, Sirintan, 16.iii.1996, leg. Yupa Hanboonsong (13) (NHMW); 2 ♂ 2 ♀ apt., Ubon Ratchanthani, Tasala, 16.iii.1996, leg. Yupa Hanboonsong (13) (KKUA, NHMW); 3 ♂ 4 ♀ apt., same locality data, 7.vii.1996 (18) (KKUA, NHMW); 1 ♀ apt., Ubon Ratchanthani, Muang, Han Phudua, 16.iii.1996, leg. Yupa Hanboonsong (14) (KKUA); 3 ♂ 3 ♀, all apt., Khon Kaen Prov., Phu Phan Kham N.P., Ban Noon Huan Chang, Huai sam Caen, (upper stream of Nam Phong River), N9521, N9523, 21.xi.1995, leg. N. Nieser, (NCTN, PPCC); 15 ♂ 8 ♀ apt., same locality, leg. H. Zettel (20a) (NHMW, PPCC); 5 ♂ 3 ♀ apt., same locality, leg. H. Zettel (20b) (NHMW); 3 ♂ 1 ♀, all apt., Kanchanaburi, River Kwai, 20.xii.1981, leg. N. M. Andersen (ZMUC); 1 ♂ 5 ♀ apt., Chantaburi Prov., Horticulture Research Centre, Dept. of Agriculture, 15 km E of Chantaburi city, stream, 29.i.1995, leg. P.P. Chen (PPCC, NHMW); 1 ♂ 1 ♀ apt., Surin Prov., Surin, 150 m, 5.-10.12.1995, leg. P. Schwendinger (NHMW); 9 ♂, 2 ♀ apt., Songkhla Prov., Hat Yai, SW of Songkhla, 21.xi.1979, leg. P. Nielsen (ZMUC, NHMW); VIET NAM: 4 ♂ 3 ♀ Quang Tri, 1 mi. N of Quang Tri, 9.v., 15.v., and 9.vi.1970, leg. A.R. Gillogly (JTPC, NHMW); 5 ♂ 7 ♀ apt., Gia Lai-Kontum, 20 km N of Pleiku, 650 m, 9.v.1960, leg. S. Quate (BIMC, JTPC, NHMW); 2 ♂ 5 ♀ apt., Gia Lai-Kontum, Pleiku, 700 m, 8.-14.v.1960, leg. S. Quate (BIMC); 1 ♀ apt., Gia Lai-Kontum, 25 km SW of Pleiku, 400 m, 12.v.1960, leg. S. Quate, (BIMC); Lam Dong, 45 km E of Da Lat, 850 m, 5.v.1960, leg. S. Quate, 2 ♂ (a) (BIMC); 5 ♂ 8 ♀ apt., 2 ♂ 4 ♀ macr., Song Be: Nam Cat Tien NP, 1.-15.5.1994, leg. Pacholátko & Dembicky (NHMW, PPCC); MALAYSIA: 12 ♂ 13 ♀ apt., Pahang, river 65 km NE of Segamat, CL 2086, 22.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 32 ♂ 50 ♀ apt., Pahang, river 65 km NE of Segamat, CL 2086, 22.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW, PPCC); 2 ♀ apt.,

Pahang, King Geo. V. Nat. Park, Kuala Tahan, 12.-15.xii.1958, leg. T.C. Maa (BIMC); 1 ♀ apt., Pahang, S. Kinchin, 13.vi.1989, leg. C.M. Yang, ZRCS2617 (ZRCS); 1 ♂ 1 ♀ apt., Johor, swamp forest stream, 15 km W of Sedili Besar, 20 m, 16.x.1986, CL 2218, leg. J.T. & D.A. Polhemus (JTPC); 1 ♂, 1 ♀ apt., 2 ♂ macr., Johor, 27 km S of Mersing, slow shaded stream, CL 2058, 14.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); 1 ♂ 4 ♀ apt., Johor, blackwater river 2 km W of Sedili Besar, 0-50 m, 16.x.1986, CL 2219, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 7 ♂ apt., Johor, Tg. Sedili, Sg. Selang, muddy water, sandy bottom, up to 1.5 feet water, 22.iv.1992, Y792A, leg. K.L. Yeo (ZRCS); 4 ♂ 4 ♀ apt., Johor, S. Bong, 5.iv.1992, Y788L, leg. K.L. Yeo (ZRCS); 8 ♂ 5 ♀ apt., Johor, S. Endau, nr. base camp (partly night collecting), 3.-5.iv.1992, Y788A, Y788B, and Y788J, leg. K.L. Yeo (ZRCS, NHMW); 1 ♂ 4 ♀ apt., Johor, Endau, Sungai Jasin, 3.iv.1992, L185, leg. H.K. Lua (ZRCS); 1 ♂ 1 ♀ apt., Johor, S. Jenahang, 4.viii.1963 (ZRCS); 1 ♀ macr., Negeri Sembilan, 10 km S of Seremban, CL 2059, 14.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); 2 ♂ 3 ♀ apt., Negeri Sembilan, 9 km S Simpang Pertang, Sering River, 10.iv.1994, A-1062, leg. W.D. Shepard (CSS, NHMW, PPCC); 28 ♂ 26 ♀ apt., Negeri Sembilan, 14 km NW Kota, unnamed stream, 9.iv.1994, A-1056, leg. W.D. Shepard (CSS, NHMW, PPCC); 1 ♀ apt., Negeri Sembilan, Ulu Bahau, Rubber Estate, 17.iii.1964, ZRCS6.6481 (ZRCS); 1 ♂ apt., Negeri Sembilan, S. Jelai, 1.xi.1963 (ZRCS); 2 ♂ apt., Selangor, Dusun Jua, 17 miles from Ditch, 26.viii.1926, coll. Dover (BMNH); 4 ♂ 2 ♀ apt., Selangor, North Selangor Peat swamp-forest stream at 43 km mark on road to Sg. Besar, 19.vi.1991, leg. H.K. Lua & Mala, LHK159 (ZRCS, NHMW); 15 ♀ apt., Selangor, Ampang, nr. Sg. Kongsi Laban, 500, small pond, 13.iii.1964, leg. L. Cheng, ZRCS6.6456-6470 (ZRCS); 2 ♀ apt., Upper Perak, Longgong, surface of irrigation channel, fast water, 22.x.-5.xi.1926, coll. Dover (BMNH); 4 ♂ 4 ♀ apt., Kelantan,

Sg. Sat, 11.xii.1964, leg. A. Jothy (JTPC, NHMW); 1♂ apt., Kelantan, Sungai Hulu Besut, 6 km (W?) after Kampang Keruah, on road to hydroelectric station, 20.iii.1992, L184, leg. H.K. Lua (ZRCS); 4♂ 4♀ apt., P. Tioman, tributary of Sg. Paya, brackish water, 25.vi.1996, leg. C.M. Yang, 'Yüi' (ZRCS, NHMW); 4♂ 4♀ apt., P. Tioman, Sg. Kililing, 27.vi.1996, leg. H.K. Lua, Y136 (ZRCS); 1♂ 1♀ apt., Terengganu, Sg. Terengganu tributary, Sekayu, 16.v.1995, leg. Bruce Tan & Sumita, TG6 (ZRCS); 4♂ apt. Prov.?, Sungai Kingsi, Laban, leg. L. Cheng (JTPC); 3♂ 3♀ apt., Prov.?, Sg. Belat, 26 km from Kuantan, 15.v.1995, leg. Bruce Tan & Sumita, TG3 (ZRCS, NHMW); SINGAPORE: 2♀ apt., 16.5 mls. from Mersing, Mersing-Kluang Rd., 4.viii.1963, leg. L. Cheng (BMNH); 6♂ 5♀ apt., pond nr. MacRitchie Reservoir, 11.5.1993, NS25 (ZRCS, NHMW); 6♀ apt, Botanical Gardens pond, 6.iv.1990, leg. C.M. Yang & H.K. Lua (ZRCS); 4♂ apt., Bukit Batok Nature Park, 10.7.1995, leg. H.K. Lua, LHK282 (ZRCS); 4♂ 3♀, stream at Lower Pierce, 21.vii.1990, Y21B (ZRCS); 2♀ apt., Stream H, Sime Road, 5.vi.1995, leg. H.K. Lua et al. NS181 (ZRCS); INDONESIA: 27♂ 18♀ apt., 1♂ 1♀ macr., Sumatra, Bengkulu Prov., Bantiring River, 7 km E of Bengkulu, 30 m, 6.ix.1991, CL 2580, leg. D.A. & J.T. Polhemus (JTPC, NHMW, PPCC); 1♂ apt., (Borneo), Kalimantan Timur Prov., waterfall 4 km S of Kota Bangun, 29.viii.1985, CL 2095, leg. J.T. & D.A. Polhemus (JTPC); 1♂ apt., 1♀ macr., Kalimantan Timur Prov., Borneo, waterfall and stream, 11 km NE of Samarinda, CL 2091, 27.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); 5♂ 7♀ apt., 1♀ macr., 8 larvae, Kalimantan Timur Prov., Kedang R., 12 km above Maura Kedang, 0.6°S, 116.2°E, leg. M.S. Christensen (JTPC, PPCC, NHMW). 10 males macr. Myanmar (Burma): Bago Division, 33 km W of Oktwin, Bago Yoma, Sein Yai Forest Camp, Selnyay River, 170 m, 29.x.1998, leg. H. Schillhammer (NMW, PPCC).

Redescription

Dimensions. – Apterous form. Length 2.54 (♂), 3.10 (♀), width 1.90 (♂), 2.05 (♀), width of head 1.10 (♂), 1.10 (♀).

Colour (fig. 128). – Whole body prominently yellowish, with distinct dark marks. Eye blackish. Interoculus pale, with one large dark mark, dark mark along inner margin of eye reaching posterior margin of vertex, but in the case of paralectotypes indistinct. Antennal segments dark, except basal 1/3–1/4 of segment 1. Pronotum usually yellowish with two lateral dark marks. Mesonotum yellowish with dark lateral stripes. Metanotum with square lateral dark mark. Mesopleura yellowish, its anterior half with a dark stripe; external angle of metacetabula dark (figs. 73, 74). Fore leg dark with basal 1/3 of fore femur yellowish (fig. 95). Middle and hind legs dark. Tergite 1 completely dark, 2–5 dark, with central light mark, 6–8 yellowish. Laterotergites 1–2 dark along the edge, 5–7 yellowish, Connexiva 1–5 dark, 6–7 yellowish. Venter yellowish.

Pilosity. – Inner surface of antennal segment 1 with 3 subbasal, and 1 subapical long spines; through basal half of segment 1 to apical half of segment 4 with silvery fine hair fringe; segments 2–4 with scattered dark short setae (fig. 66). Dorsum and pleura bearing dark pubescence. Venter clothed by golden pubescence,

especially on genital segments, the pilosity very long and dense. Fore femur and tibia with silvery fine hair fringe. Longer stiff spines scattered along middle and hind legs. Basal part of middle and hind femur with a very long trichobothria-like seta on dorsal surface.

Structural characters. – Interoculus broader than width of an eye, 0.42 : 0.31 in male. Antennae not modified, segment 2 longer than 3 in males (fig. 66), roughly of same length in females (measurements see table 1). Thorax not bulbous, mesonotum somewhat swollen, its lateral width 1.02. Intersegmental suture between meso- and metanotum distinct. Metanotum somewhat declivent. Lower part of metacetabula truncate (fig. 87). Metasternal tubercle slightly prominent in male. Fore femur slender and not modified, claw rising from 1/3 of segment 2 of fore tarsus. Anterior margin of abdominal tergite 1 distinct; anterior margins of tergites 2 and 3 obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes.

Male terminalia. – Parameres (figs. 102–113) symmetrical, twisted in middle part, apically strongly widened, with distinct tubercle, with rounded apex, extending beyond genital segments. Endosoma (fig. 119–122): dorsal sclerite long and recurved proximally, ventral sclerites long, lateral sclerites straight, proximal parts broadened and hooked, second lateral sclerites thin, apical sclerite indistinct.

Female terminalia. – Abdominal sternite 7 large, posterior margin smooth, slightly concave anteriorly (fig. 59).

Macropterous form. – (After specimens from Sri Lanka). Colouration: pronotum black with a large round yellowish central blotch. Wings anteriorly black with fine pubescence and with scattered longer black hairs. Posterior membranous part of wings dark brown. The other morphological characters as in apterous form except the apex of pronotum pointed (measurements see table 3); length of fore wings from humeri to apex 2.02.

Variability. – In contrast to most other species of *Ventidius*, *V. modulatus* shows a surprising variability in dorsal colour pattern and size, but specimens from the same sample are usually similar in these characters. Bright yellowish specimens are mainly found in Malaysia, where dark-coloured populations are also found. In a large sample from Negeri Sembilan (A-1056, leg. Shepard) all specimens have a completely yellowish thorax. Specimens from Sri Lanka always have dark lateral stripes on mesonotum, specimens from Thailand mostly so; there are only a few samples with differently coloured specimens, e.g. that from Udon Thani Prov., Thailand. Pubescence of thorax is also similar between specimens of the same sample.

We include within *V. modulatus* also a dark-coloured population from Viet Nam (Gia Lai-Kon-

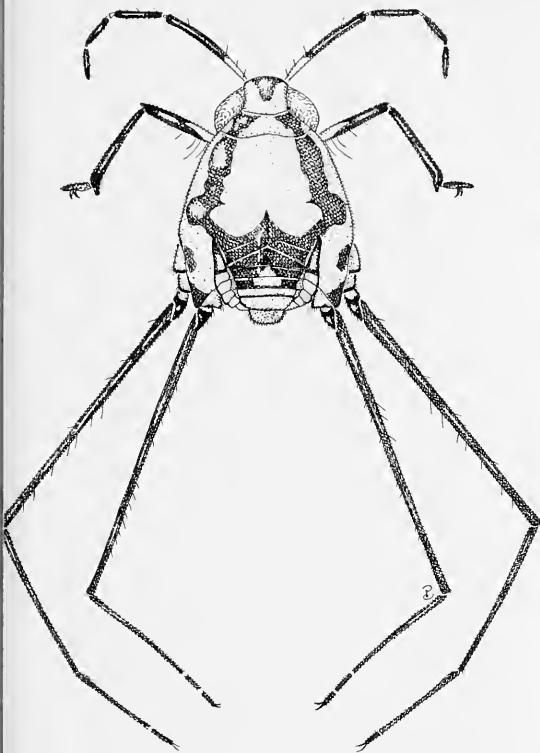


Fig. 128. *Ventidius* (s. str.) *modulatus*, lectotype, apterous male, length 2.54 mm.

tum), which shows a slightly thickened antennal segment 1 in males (length : width = 12.5-13.5), denser and longer pilosity and a more flattened body than in other populations within the large area of *V. modulatus*. These specimens resemble somewhat *V. hungerfordi*, but, beside genitalia structures, the antennal segment 1 of males is distinctly less stout (9.5-11.5 in *V. hungerfordi*) and the pleural colour pattern is different. We have also seen intermediate *V. modulatus* specimens from Northeast Thailand, so that we are sure that the Viet Nam population is no more than a geographic, infrasubspecific form of *V. modulatus*.

Distribution (map 3). – Sri Lanka: Northern Prov., North Western Prov., Central Prov., Uva Prov.; India: West Bengal State; Thailand: Chiang Mai, Lampang, Tak, Phitsanulok, Khon Kaen, Ubon Ratchanathi, Kanchanaburi, Chantaburi, Surin, Songkhla; Viet Nam: Quang Tri, Gia Lai-Kontum, Lam Dong, Song Be; Malaysia: Selangor, Johor, Perak, Pahang, Negeri Sembilan; Singapore; Indonesia: Sumatra, Java, Kalimantan.

Comparative notes. – This species is similar to the four preceding species (*V. hungerfordi*, *V. polhemorum* sp. n., *V. werneri*, and *V. pilosus* sp. n.), and differs mainly in the slender antennal segment 1 of males (much thicker in *V. hungerfordi* and *V. polhemorum*, slightly thicker in *V. werneri* and *V. pilosus*), and a shorter pubescence on metapleura. The paramere is especially similar to that of *V. hungerfordi*, but differs from that of the other species by having a distinct ruberle.

Remarks. – As the synonymies of the taxa *V. modulatus*, *V. chinai*, and *V. pubescens* are problematical, we feel obliged to give a detailed analysis of the type specimens:

We have studied three of the four male syntypes of *V. modulatus* Lundblad 1933, from West Java, which are deposited in the SMNH. One of them bears the label 'Typus' and is presently designated and labelled as lectotype, the other two with the label 'Paratypus' as paralectotypes.

Ventidius chinai was based on two males and two females from Selangor in Malaya. In the comparative notes by Hungerford & Matsuda (1960) it is compared with *V. aquarius*, but this species is not closely related. In the key by Hungerford & Matsuda (1960) *V. chinai* is compared with *V. werneri* and *V. henryi* by colouration; due to a mistake (paragraph 6' is missing) the comparison with *V. modulatus* is not clear, but mainly based on the shape of parameres and more (in *V. modulatus*) or less (in *V. chinai*) developed sutures between the meso- and metanotum and the metanotum and tergite 1. The description of the paramere of *V. chinai* is based on the incomplete paramere of the holotype (apical part lacking) and therefore useless for a comparison; strangely enough we have seen two males from Selangor (also from the Dover collection) with similarly broken parameres. We could not find any proper differences in the development of thoracic sutures between *V. chinai* and *V. modulatus*. Differences mentioned by Hungerford & Matsuda (1960) may be due to the figure of Lundblad (1933: pl. xii) which shows very pronounced sutures; in fact the sutures are faint but partly dark-coloured in one type specimen investigated. The dark colour pattern is extremely reduced in the types of *V. chinai*. The thoracic hairs are partly rubbed off, so that an investigation is difficult. In the centre of the mesopleura the hairs are short as in the types of *V. modulatus*.

Ventidius pubescens was based on numerous specimens from Johor in Malaya (Cheng 1965). We have studied the holotype and several paratypes, which have a uniformly reduced dark colour pattern. Cheng (1965) re-described *V. modulatus* after 'a mating pair' from Pahang, Malaysia, but compared *V. pubescens* with *V. chinai* on the assumption that '[t]he colour pattern is also quite a constant character' (Cheng 1965: 153). The main difference between *V. pubescens* and *V. chinai* is, according to Cheng (1965), the dif-

ferent shape of parameres. As this is based on the broken paramere of *V. chinai*, this character is useless. Furthermore, Cheng (1965) stated: '*V. pubescens* also differs from the latter species [= *V. chinai*] in the possession of the mesosternal groove, densely haired body and differently proportioned antennal and leg segments.' The 'mesosternal groove' mainly consists of an internal ridge medianly on the mesosternum and can be more or less seen through the cuticula; it is more easily visible in specimens preserved in alcohol (*V. pubescens* paratypes) than in dried specimens (as type specimens of *V. chinai*). We could not find any important differences in ratios of the antennal and leg segment of the type specimens of *V. chinai* and *V. pubescens* for these parts which are still present in the types of *V. chinai*. Indeed there is a difference in the pubescence of *V. pubescens* and *V. chinai* (and *V. modulatus*), not so much in the general dorsal appearance (which we think is due to the bad condition of the type specimens of *V. chinai*), but more in a longer pubescence in the middle part of mesopleura of *V. pubescens*. This character can be seen only under high magnifications and is the only character we found to distinguish *V. pubescens* from *V. modulatus* and *V. chinai*. Body pubescence has been shown to be important for protection against UV-radiation in different genera of Gerridae (Cheng et al. 1978, Andersen 1990); therefore it could be variable under different microhabitat conditions. As the types of *V. pubescens* correspond in all other characters either with *V. modulatus* and/or with *V. chinai*, we regard it as synonymous with *V. modulatus*. Although there may be some doubts about the synonymy of *V. pubescens* and *V. modulatus*, we regard it presently more practical to treat them as one species than to separate them only by the difference in pubescence which is very difficult to observe. Recently, a sample including only macropterous specimens was collected at Bago Yoma, Burma (c. 18°47'N, 96°21'E), which is close to the type locality of *V. distantii* (c. 20°35'N, 96°58'E). The paramere shows the typical shape of the *V. modulatus*-group. We suspect that these macropterous specimens from Bago Yoma are *V. distantii*. In that case, further study of *V. distantii* and *V. modulatus* will be needed (see also under *V. distantii*).

12. *Ventidius* (s. str.) *distantii* Paiva (fig. 129, map 3)

Ventidius distantii Paiva, 1918: 25, pl. VIII, fig. 4 (descr., illustr.); Esaki 1928: 511 (comparative notes); Dover 1929: 69 (misidentif.); Esaki 1930: 18 (considers as valid species, misidentif.); Lundblad 1933: 372 (list, comp. with *modulatus*); Hungerford & Matsuda 1960: 332 (discussion, key).

Type locality. — MYANMAR (BURMA): Yawnghe State.

Types [not examined]. — 'Described from several specimens in alcohol, from the top of gorge of the He-Ho River, Yawnghe State, ca. 3,500 ft., 7-iii-1917' (Paiva 1918).

Description

Since we have no material either from the type series or other specimens from the type locality, we adopt the main description points given by Paiva (1918) which are based mainly on colour characters.

Dimensions. — Apterous form. Length 3.00.

Colour and structural characters. — 'Head black with a large patch at base, and a transverse fascia at apex of face yellowish ochraceous; eyes silvery grey, with a black patch on the disk; antennae black, basal half of first joint yellowish. Pronotum very short, black, a narrow ochraceous weaved fascia at basal margin, anterior margin slightly concave, posterior margin almost straight. Mesonotum large, about as long as its greatest breadth (Esaki (1930) pointed out that '[h]is 'mesonotum' evidently includes a part of the metanotum'), covered with decumbent hairs, disk obliquely striate on anterior area, ochraceous, with two broad lateral black fasciae curved inwards anteriorly and meeting narrowly on anterior margin, each extended posteriorly to meet a curved fascia on the intermediate acetabula; a large subtriangular patch at centre of posterior margin; the posterior lateral angles narrowly dull black. Metanotum dull black with a small ochraceous spot near each basal angle. Abdomen above dull white, the basal segment, a spot at lateral margin of each segment and the apical segment black. Underside pale ochraceous; legs black, base of anterior femora ochraceous.'

Distribution (map 3). — Myanmar: Yawnghe.

Remarks. — The type material of this species was deposited in the collection of the Zoological Survey of India (type No. 7152/H.i.), but is so far not available for study. We quote here the notes from the revisionary paper of Hungerford & Matsuda (1960): 'Dr. P. Kapur of the Calcutta Museum is now unable to find this type in their museum and it may have been lost by high water in the temporary quarters in 1943. This is most unfortunate since only a re-examination or the type of a study of a series of specimens from the type locality the identity of *Ventidius distantii* can be established.'

Judging from the drawing (fig. 129) and the description given by Paiva (1918) we consider *V. distantii* as belonging to the *V. modulatus*-group; the specimen figured is probably a female. Species of the subgenus *Ventidioides* usually have the pronotum completely black (never with a yellow mark medially on hind margin as figured by Paiva). Species of the *V. aquarius*-group are larger in size (Paiva states 3 mm for *V. distantii*) and have longer antennae and stouter middle and hind femora than figured by Paiva (1918). Re-

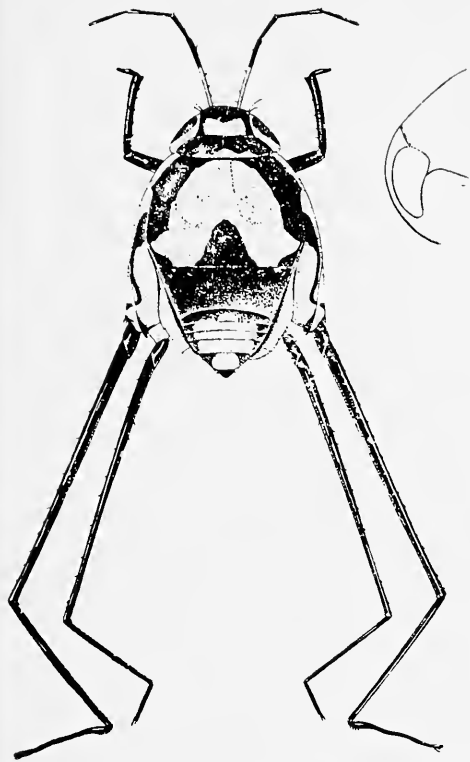


Fig. 129. *Ventidius* (s. str.) *distanti*, apterous male, reproduced from Paiva's drawing (1918).

cently we have obtained records of *V. modulatus* from India and Sri Lanka, which shows that this species is widely distributed and probably also occurs in Myanmar (although we have no records from this country).

As the description given by Paiva (1918) is not sufficient, there was a confusion about the species named *V. distanti* during the following decades. Dover (1929) recorded it from Malaya (Selangor) and added to the confusion; his material was considered as belonging to two different species (see Hungerford & Matsuda 1960). One of them was established as a new species, *V. malayensis*, by Hungerford and Matsuda (1960), while the other smaller specimen—which was identified as *V. distanti* also by Esaki and China—is a *Ventidioides* sp. We agree with Hungerford & Matsuda (1960) that the morphological characteristics show clearly that this specimen belongs to the subgenus *Ventidioides*, and reject the conspecific status of this specimen with *V. distanti*. The only *Ventidioides* species presently known from Malaya (and from Selangor) is *V. pulai*.

Lundblad (1933) stated that his new species, *V. modulatus*, was similar to *V. distanti*, but differed in

the length of the antennal segments: segment 3 was longer than segment 2 in *V. distanti*, but shorter than segment 2 in *V. modulatus*. In this case—because he had only four males at hand—Lundblad (1933) walked right into a deep trap: he could not know that in this species complex (*V. modulatus*-group) usually the ratio between lengths of antennal segment 2 and 3 is completely different in males and females. If we are right that Paiva (1918) figured a female, indeed there is no obvious difference between *V. distanti* and *V. modulatus*. Furthermore, Lundblad (1933) trusted the paper of Esaki (1930); Esaki had a male at hand of which the antennal segment 2 is also shorter than segment 3; but this specimen even belongs to another subgenus (see above).

A recent sample from Burma (see also under *V. modulatus*) including only macropterous specimens, was collected at Bago Yoma (c. 18°47'N, 96°21'E), which is close to the type locality of *V. distanti* (c. 20°35'N, 96°58'E). It is quite possible that these macropterous specimens from Bago Yoma are *V. distanti*. A definitive conclusion is difficult to draw without checking the type material.

Finally, we are of the opinion that *V. distanti* should be a valid species of the genus *Ventidius* within the *V. modulatus*-group. It cannot be *V. henryi* because of the colour pattern figured by Paiva (1918) (see fig. 129), and probably not *V. hungerfordi* which has a thick antennal segment 1 and is so far only known from Southeast Asia. But until material from the type locality is available, we consider it premature to make *V. distanti* a senior synonym of one of the known sibling species in this group.

13. *Ventidius* (s. str.) *sushmae* Gupta nomen inquirendum

Ventidius sushmae Gupta, 1981: 99-102, figs. 1-12 (descr., illustration).

Type locality. — INDIA: West Bengal, Darjeeling, Sukna.

Types [not available for examination]. — 'The type specimens are for the time being retained in the department of Zoology, B.S.A. College, Mathura (U.P.) but subsequently would be deposited in the National Collection of Zoological Survey of India, Calcutta' (Gupta, 1981). The type series includes 10 apterous males and 8 females, and 6 macropterous males and 4 females.

Description

We were not able to study type material of *V. sushmae*. We adopt the description given by Gupta (1981) as below:

Dimension. — Apterous form, length 2.40 (♂), 2.60 (♀), width 1.85 (♂), 2.10 (♀), width of head 1.05 (♂), 0.95 (♀).

Colour. — Dorsal surface yellowish-brown in

ground colour with black markings. Head yellowish-brown, a median somewhat triangular and a pair of lateral black stripes, confluent anteriorly. Pronotum yellowish-brown with lateral longitudinal black stripes. Mesonotum yellowish-brown with a pair of lateral longitudinal black stripes. Metanotum yellowish-brown with black stripes on fifth, sixth and seventh tergites. Venter light brown. Connexivum yellowish-brown laterally. Antennae and legs brown.

Pilosity. – Fore femur of male not clothed with long hairs on inner margin.

Structural characters. – (The measurement of antennae and legs were given by Gupta for both apterous and macropterous form. As the scale was not in millimetres, his data are excluded from the tables in this paper). Head including eyes much wider than long. Eyes exserted, rounded on outer margin, strongly emarginate on inner half margin, covering entire lateral margin of pronotum and anterior angle of mesonotum. Antenniferous tubercles not developed. Proportional length of antennal segments see table 1. Clypeus with balsa margin lost. mandibular and maxillary plates well demarcated from each other. Rostrum short, clearly surpassing hind margin of prosternum, third segment about three times longer than last segment [7.2: 2.4 (♂), and 7.5: 2.5 (♀)]. Pronotum short, transverse, lateral margin rounded, both anterior and posterior margins concave. Intersegmental suture between mesonotum and metanotum poorly defined dorsally, obliterated laterally in front of metathoracic spiracle. mesosternum without a small tubercle on median longitudinal axis. Metanotum without median longitudinal sulcus, lateral longitudinal suture not meeting intersegmental suture. Metacetabular suture clearly reaching anterolateral angle of first abdominal tergite dorsally. Metacetabulum broad, with posterolateral angle simple. Metasternum highly reduced, represented by a small transverse subtriangular plate. Omphalium highly reduced, located closer to posterior margin than to anterior margin of metasternum. Omphalial groove absent. Fore leg relatively long, femur slender, simple, without a tubercle in male; tibia with a conspicuous narrow apical process; tarsus with first segment much shorter than second segment. Claws arising from about middle of second segment. Abdomen broad and short. First tergite nearly straight on anterior margin. Anterior margin of second and third tergites produced anteriorly, obliterated medially. Abdominal spiracles hidden beneath metacetabula and hind legs, situated about in the middle between both the margins of each segment. Ventral longitudinal suture of connexivum not retained. Median ventral longitudinal carina absent. Seventh ventrite a little shorter than all preceding ventrites together, deeply concave on apical margin.

Male terminalia. – Eighth segment with dorsal posterior margin broadly rounded, ventrally concave on apical margin. Ninth segment with suranal plate simple; pygophore with apical margin simply rounded; parameres well developed, symmetrical. Endosoma with definitive dorsal plate curved back along apical margin of endosoma; simple at apex; ventral plate indistinguishably fused with dorsal plate, supported by basal plate; lateral plates simple, elongated, weakly sclerotized, with small downward projection apically. A V-shaped sclerite lying over dorsal plate.

Female terminalia. – Seventh segment ventrally distinctly longer than all preceding segments together, nearly straight on hind margin, narrowly rounded apically; intervalvular membrane with its apical margin broadly concave, valva large totally membranous.

Macropterous form. – Length 3.58 (♂), 3.72 (♀), width 1.90 (♂), 1.92 (♀), width of head 1.10 (♂), 1.14 (♀).

Wing venation: Hemelytra with distinct embolium. R+M+Cu vein divided into two veins, R+M and Cu at basal third of the wing; two apical cells are formed, lower cell is relatively longer than vein A joined at its extremity. Vein also joined with rear margin of wing at about middle by a short cross vein.

Distribution (map 3). – India: West Bengal.

Remarks. – Gupta (1981) correctly put this species in subgenus *Ventidius* (s. str.). He discussed and keyed the difference of the two subgenera: *Ventidius* (s. str.) and *Ventidius* (*Ventidioides*). The comparative notes of this species with other species of *V. modularis*-group were not given. But he mentioned that he has compared this species with *V. aquarius* Distant, although he wrote: 'Unfortunately, the type specimen (of *V. aquarius* Distant at Z.S. I., Calcutta) is poorly mounted on a slide and is damaged.' The illustration given by him is reasonable and shows great similarity to *V. modularis* Lundblad. The original description and drawings, especially the lateral view of paramere, fit very well with *V. modularis*. Further, we have studied specimens of *V. modularis* from Sri Lanka. Although we suspect strongly its status as a good species, until checking the type material we treat here this species as a valid species in the *V. modularis*-group of the subgenus *Ventidius*.

Ventidius (*Ventidioides*) Hungerford & Matsuda

Ventidius (*Ventidioides*) Hungerford & Matsuda, 1960: 335-336. Type species by monotypy: *Ventidius* (*Ventidioides*) *kuiterti* Hungerford & Matsuda.

Diagnosis. – Dorsal dark colouration more prominent and not varying as much as in *Ventidius* s. str.; antennae stouter than in *Ventidius* s. str., in males the length of antennal segment 1 approximately as long

as segments 2-4 together, from basal half of segment 1 to segment 3 or 4 with a fine pubescence of erect hairs ventrally; posterolateral angle of metacetabula bilobate; mesosternum of male with a small, in some species very prominent, tubercle at the end of the median groove, either with a row of dark setae anteriorly of the tubercle, or the tubercle more or less covered with a tiny tuft of setae; surface of male fore femur in middle of its length with a small tooth, a broad tubercle or simple; parameres asymmetrical, left paramere stronger than right one.

Distribution (maps 4, 5). – Widely distributed in the Oriental region (in the Southeast Asian mainland from Myanmar to Malaysia, and in Borneo) and reaching the Wallacea (Sulawesi). Unknown from the Indian region.

Identifications. – The following key for apterous males may be also used for macropterous males in most characters, but as the thickening of fore femur and fore tibia is less developed in this morph, this character can not be used to distinguish *V. kurtokalami* and *V. nieseri* sp. n. Females are very difficult to distinguish in most species, but females of the *V. kuiterti*-group differ partly in colour and length of antennal segments, body length and colouration. The Sulawesi species of the *V. xiphibion*-group (*V. xiphibion* and *V. xyle*) also show a different colour pattern in females, which is not very reliable, because both species show some variations. The same is true for the Bornean species *V. kurtokalami* and *V. nieseri* sp. n. The female of *V. heissi* sp. n. is unknown.

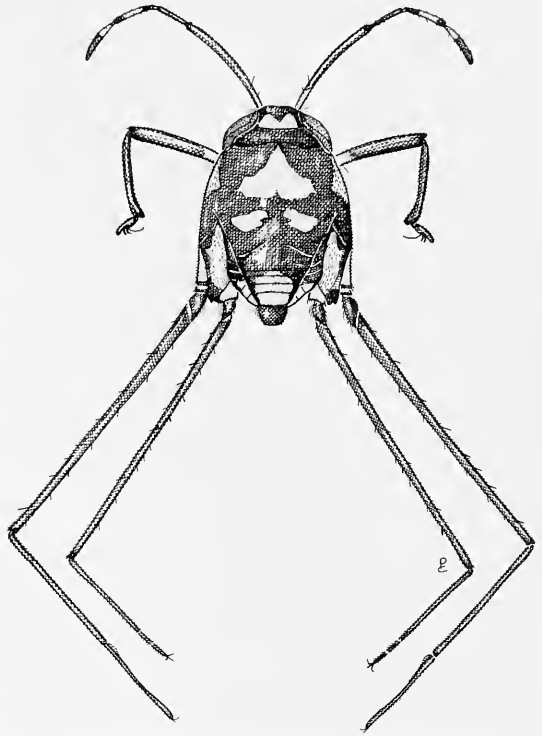


Fig. 130. *Ventidius* (*Ventidioides*) *kuiterti*, paratype, apterous male, length 2.46 mm.

Key to apterous males of the subgenus *Ventidioides*

1. Ventral surface of fore femur with a small, sharp tooth in middle of its length (fig. 148); mesosternum without a row of dark setae anterior of tubercle, but the tubercle may be more or less covered by dark setae (fig. 132); endosoma with two pairs of lateral sclerites (fig. 4) (*V. kuiterti*-group; species from the Southeast Asian mainland)2
- Ventral surface of fore femur without a sharp tooth, but sometimes in middle of its length with a blunt tubercle or thickening (figs. 198-202); mesosternum with a row of black setae anterior of tubercle (fig. 215); endosoma with three pairs of lateral sclerites (fig. 5) (*V. xiphibion*-group; species from Borneo and Sulawesi)5
2. Antennal segment 3 shorter than segment 4, segment 3 and 4 partly yellowish3
- Antennal segment 3 subequal to segment 4, segments 3 and 4 uniformly brown4
3. Body length less than 2.6 mm; yellowish marks of meso- and metanotum separated by a black stripe (fig. 130); antennal segment 4 slightly longer than segment 3; yellowish mark on antennal segment 4 less distinct; parameres as in figs. 167, 168 (Myanmar, NE India) *V. kuiterti*
- Body length more than 2.6 mm; yellowish marks of meso- and metanotum partly confluent (fig. 183); antennal segment 4 distinctly longer than segment 3; yellowish mark on antennal segment 4 very distinct; parameres as in figs. 169, 170 (Thailand, Vietnam) *V. karen*
4. Left paramere in distal part long and slender, not twisted (fig. 176); right paramere small and rather slender (fig. 175); segment 8 with densely developed long dark pilosity (fig. 182) (Thailand) *V. lundbladi*
- Left paramere in distal part plate-like, apically twisted (figs. 172, 174); right paramere slightly broader (fig. 171, 173); pilosity of segment 8 less developed (Thailand, Laos, Malaya) *V. pulai*
5. Fore trochanter without a tuft of black setae; left and right parameres hooked upward halfway their length, with slender base (figs. 223, 224, 227, 228) (Bornean species)6
- Fore trochanter with a distinct tuft of black setae (fig. 213); inner surface of fore femur and fore

Figs. 131-132.

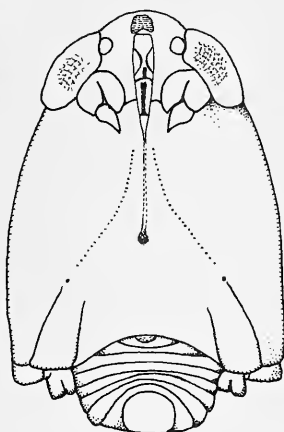
Ventidius karen. – 131, dorsal view of macropterous male (appendages removed, after Lansbury); 132, ventral view of apterous male (genital segments removed, after Lansbury).

Fig. 133.

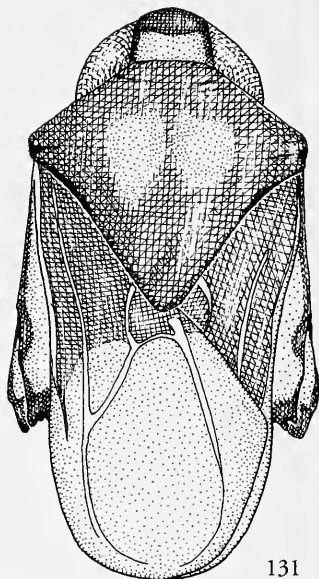
V. pulai, pronotum of macropterous form.

Fig. 134.

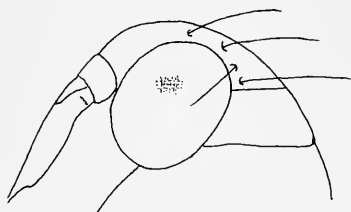
V. lundbladi, lateral view of head, showing the trichobothria of interoculus.



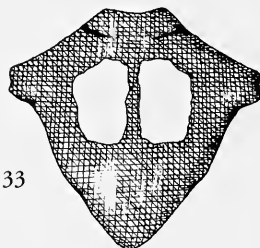
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133

- tibia without a swelling halfway its length, but slightly broadened (figs. 198, 199); left and right parameres hooked upward close to the strongly enlarged base, left paramere distinctly broader than right one (figs. 219-222) (Sulawesian species)8
6. Inner surface of fore femur and fore tibia with a more or less prominent swelling halfway its length (figs. 200, 201); row of black setae on mesosternum long; left and right parameres slender and pointed apically7
- Inner surface of fore femur and fore tibia without distinct swelling halfway their length (fig. 202); row of black setae on mesosternum less developed; both parameres thick, left paramere curved apically, right paramere blunt (figs. 225, 226)
..... *V. heissi*
7. Brighter species, yellowish marks on metanotum large, metacetabulum with two separated black marks (figs. 207, 208); thickening of fore tibia stronger developed; along mesosternal groove with

- a row of short dark setae; endosomal apical accessory sclerite indistinct (fig. 232)
..... *V. kurtokalami*
- Darker species, yellowish marks on metanotum small (fig. 236), metacetabulum in most specimens with confluent black marks (figs. 209, 210); thickening of fore tibia mainly by erect pilosity; along mesosternal groove with a row of long black setae (fig. 215); endosomal apical accessory sclerite distinct (fig. 233) *V. nieseri*
8. colouration darker, yellowish marks on metanotum usually separated from that of mesonotum; mesopleura with a dark long stripe running through its length; left and right parameres with elongate tips, right paramere not much shorter than left one (figs. 221, 222); endosomal apical accessory sclerite indistinct (fig. 231) *V. xyle*
- colouration brighter, yellowish marks on metanotum usually not separated from that of mesonotum; mesopleura with a small dark mark anteriorly, Left paramere with acute, but not elongate

tip (fig. 219), right paramere with less slender tip and much shorter than left one (fig. 220), endosomal apical accessory sclerite distinct (fig. 230).

..... *V. xiphibion*

The *Ventidius kuiterti*-group

Diagnosis. — Male fore femur in middle of its length with a small distinct ventral tooth; at the end of median mesosternal groove with a small prominent tubercle covered with short setae; parameres with blunt apex (except left paramere of *V. lundbladi*); endosoma without apical accessory sclerite, usually without third pair of lateral sclerites (but in *V. karen* with a thin third pair); in *V. kuiterti* and *V. karen* with yellowish bands on antennal segments 3-4 in both sexes, but sometimes in heavily pigmented females totally dark.

Distribution (map 4). — Endemic to the Southeast Asian mainland.

14. *Ventidius (Ventidioides) kuiterti* Hungerford & Matsuda

(figs. 130, 135-137, 142, 148, 157, 158, 167, 168, 177, map 4)

Ventidius (Ventidioides) kuiterti Hungerford & Matsuda,

1960: 333-336 (desc., illustr., key).

Type locality. — MYANMAR: Shingbwiang.

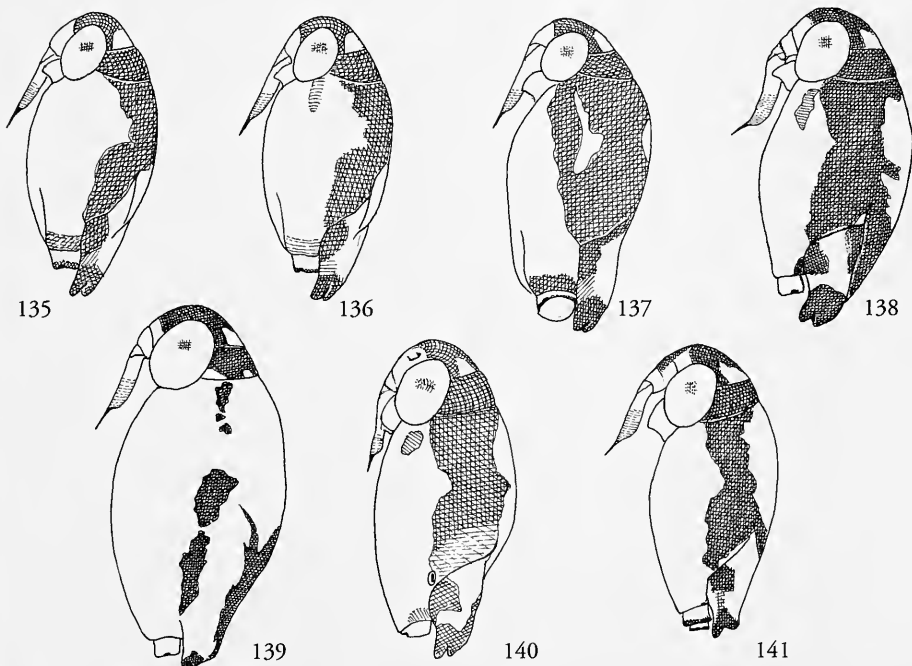
Type material examined. — Paratypes: MYANMAR [Burma]: 4♂ 4♀, apt., Shingbwiang, 24.ii.1944, leg. L.C. Kuitert (SEMC, JTPC, NHMW); 1♂ apt. Tingkaw, V.1944, leg. L.C. Kuitert (JTPC).

Other material examined. — MYANMAR: 1♂ 4♀ apt., Shingbwiang, 22.ii.1944, leg. L.C. Kuitert (SEMC, NHMW); 1♂ 1♀ apt., Tingkaw, V.1944, leg. L.C. Kuitert (SEMC).

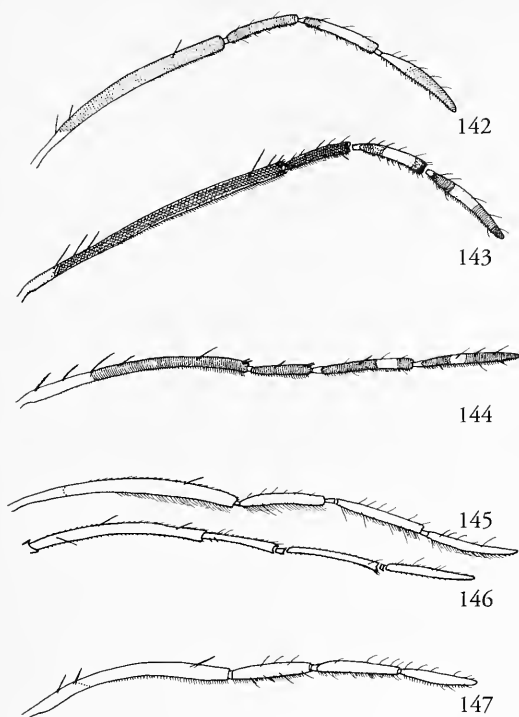
Redescription

Dimensions. — Apterous form: length 2.46 (♂), 2.60 (♀), width 1.60 (♂), 1.90 (♀), width of head 1.10 (♂), 1.20 (♀).

Colour (fig. 130). — Whole body prominently dark, with distinct yellowish marks. Eye blackish. Interoculus blackish, with one large M-shaped yellowish mark at posterior margin. First antennal segments dark except basal 1/6; second segment dark; segment 3 mostly yellowish, fourth segment brownish or yellowish at basal half. Pronotum dark, in some specimens with two small yellowish marks at the lateroposterior margin. Mesonotum yellowish with broad dark lateral stripe which confluent with the dark mark on metanotum. Metanotum with two triangular yellowish marks laterally. Mesopleura with variable colour pat-



Figs. 135-141. Lateral view of apterous males, showing the colour patterns of pleura. — 135-137, *Ventidius kuiterti*; 138, *V. karen*; 139, *V. sp.* from Viet Nam; 140, *V. pulai*; 141, *V. lundbladi*.

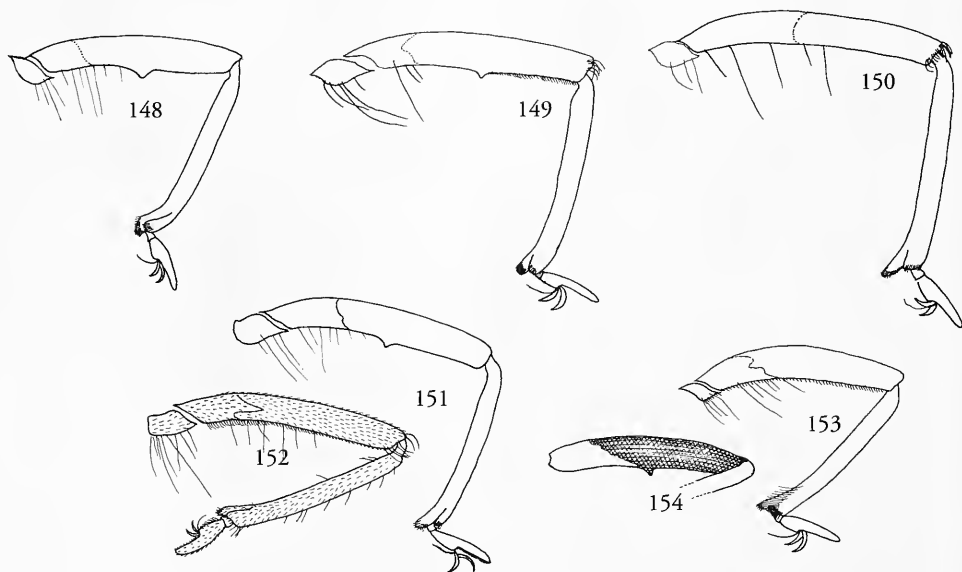


Figs. 142-147. Dorsal view of male right antennae. — 142, *V. kuiterti*; 143, *V. karen*; 144, *V. sp.*, female, from Viet Nam; 145, *V. pulai*, male; 146, same species, female; 147, *V. lundbladi*.

tern; one apterous paratype male with totally yellowish mesopleura (fig. 135); one apterous paratype male with a small brownish mark near the anterior margin of mesopleura (fig. 136); one apterous paratype female with broad dark stripe running through the length of mesopleura (fig. 137). Distal margin of metapleura brownish. External part and lower part of metacetaula blackish (figs. 157, 158). Fore leg dark with basal $\frac{1}{3}$ yellowish (fig. 148). Middle and hind legs dark. Tergites 1-3 completely dark, 4 blackish with a triangular yellowish mark in the middle, 5-6 yellowish but dark laterally, 7 yellowish, 8 dark. In males: laterotergites 1-4 blackish, 5 dark with a small pale mark, 6-7 yellowish; connexiva 1-5 dark, 6-7 yellowish. In females: laterotergites and connexiva yellowish. Venter yellowish. Metasternum yellowish.

Pilosity. — Inner surface of antennal segment 1 with 3 subbasal and 1 subapical spines, in male through basal half of segment 1 to segment 4 with dark fine hair fringe; segments 2-4 with scattered brownish short setae (fig. 142). Dorsum, pleura and metacetaula bearing dark pubescence. Venter clothed by golden pubescence, especially on genital segments, the pilosity longer and denser. In male at the end of mesosternal groove with a small tubercle, which is covered by short dark setae. Long stiff spines scattered along middle and hind legs.

Figs. 148-154. Dorsal view of right fore leg. — 148, *V. kuiterti*; 149, *V. karen*; 150, *V. sp.* female, from Viet Nam; 151, *V. pulai*, male; 152, *V. pulai*, female; 153-154, *V. lundbladi*; 153, dorsal view; 154, posteroventral view of fore femur, showing the tooth.



Structural characters. – Interoculus subequal to width of an eye, 0.40 : 0.40 in male, 0.45 : 0.40 in female, respectively. Antennae not modified, measurements see table 1. Thorax not bulbous, mesonotum somewhat swollen, its lateral width 0.90 (♂), 1.30 (♀). Intersegmental suture between meso- and metanota obscure. Metanotum somewhat declivent. Lower part of metacetaula bilobate (figs. 157, 158). Metasternum not prominent. Fore femur of male slightly incrassate, halfway its inner surface with a small tooth (fig. 148), claw rising from 2/5 of segment 2 of fore tarsus. Anterior margin of abdominal tergite 1 obscure, anterior margins of tergites 2 and 3 obscure but eventually obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes. Laterotergites broad.

Male terminalia. – Parameres (figs. 167, 168) asymmetrical, both hooked subbasally, left paramere larger than the right one, with blunt apex, extending beyond genital segments. Endosoma (fig. 177): dorsal sclerite long and recurved proximally, ventral sclerite long, lateral sclerites straight, hooked distally and broadened proximally, second lateral sclerite long and thin.

Female terminalia. – Abdominal sternite 7 large, posterior margin smooth, anteriorly concave.

Macropterous form. – Unknown.

Distribution (map 4). – Myanmar: Shingbwayang. India: Arunachal Pradesh.

Comparative notes. – This species is most similar to *V. karen*, for differences see under comparative notes of that species.

15. *Ventidius* (*Ventidioides*) *karen* Lansbury

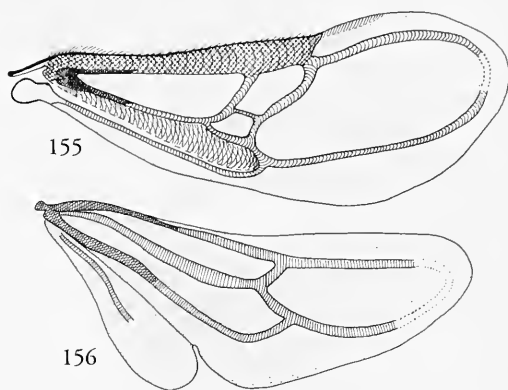
(figs. 131, 132, 138, 143, 149, 159, 160, 169, 170, 178, 181, 183, map 4)

Ventidius karen Lansbury, 1988: 61-66 (descr., illustr.); Zettel & Chen, 1996: 152, 181 (list, rec.).

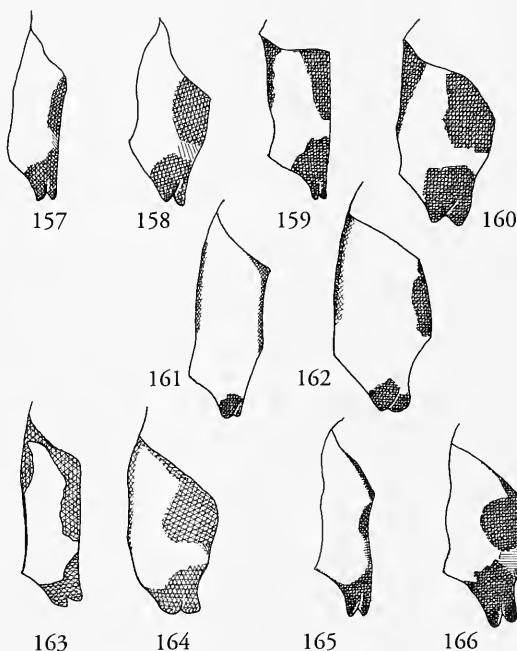
Type locality. – THAILAND: Nakhon Ratchasima.

Type material examined. – Holotype, ♂, apt., THAILAND: [Nakhon Ratchasima], Khao Yai National Park, Pha Kuai Mai Waterfall, 6.xi.1987, leg. C. Deelman (OUMC). Paratype ♂, apt., same data as holotype (OUMC).

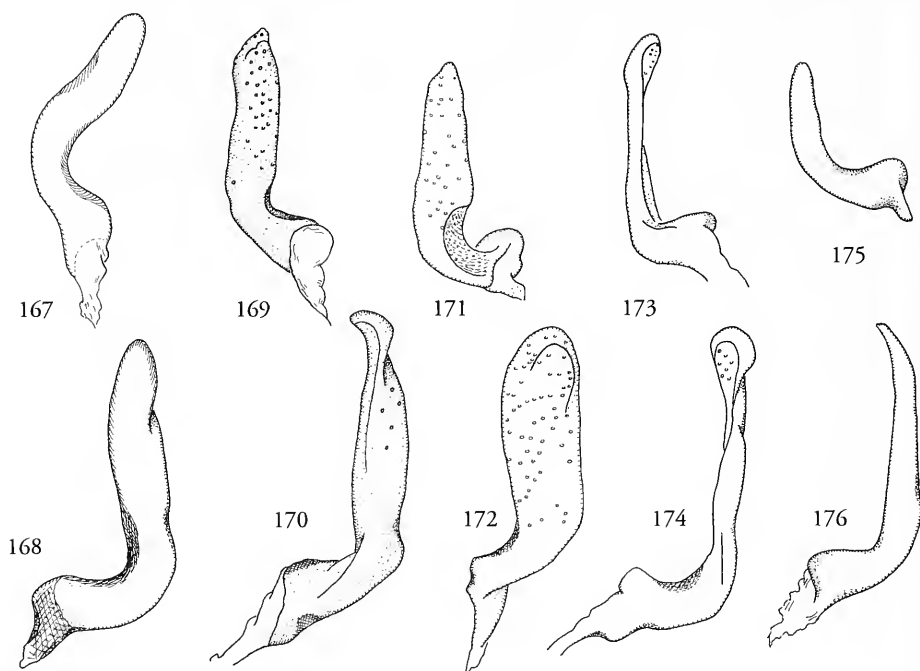
Other material examined. – THAILAND: 3♂ 9♀ all apt., 17lv., Phetchabun Prov., Huai Nam Phang, S. Ban Nam Nao, 25.xi.1995, leg. H. Zettel; ca. 31 km NW der Abzweigung von der Straße Lom Sak-Chumpae, ca. 5-6 m breiter Fluß, sehr stief, sehr schlammig (NHMW, PPCC); 5♂ 3♀ all apt., Petchabun Prov., Nam Nao N.P., Huai Phrom Laeng, 2-3 m breiter Bach, 24.xi.1995, leg. H. Zettel (22) (NHMW); 75♂, 90♀ all apt., VIET NAM: Gia Lai-Kontum Prov., 40 km NW An Khe, Buon Luoi, 14°10' N., 108°30' E., 620-750 m, 28.iii.-12.iv.1995, leg. Pacholatko & Dembicky (NHMW, NCTN, PPCC, BMNH, ZRCS).



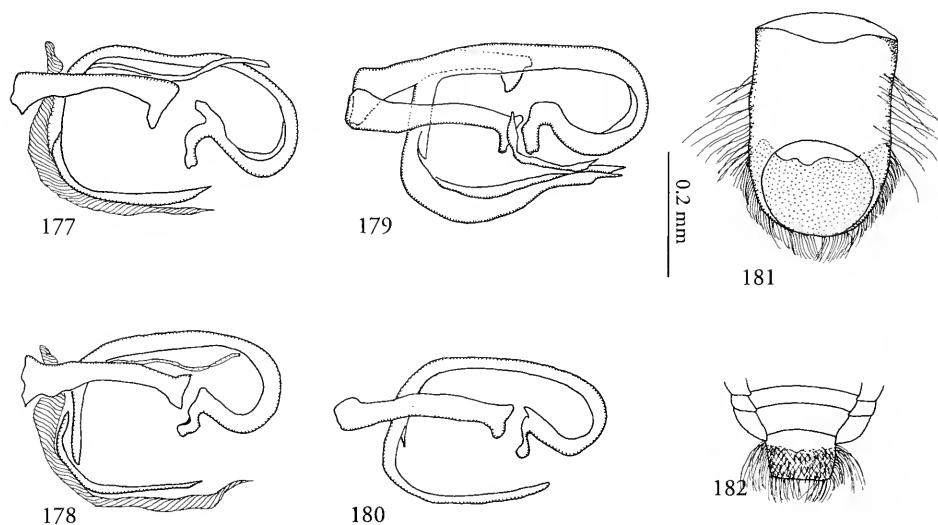
Figs. 155-156. *V. pulai*. – 155, dorsal view of fore wing (after Cheng); 156, dorsal view of hind wing (after Cheng).



Figs. 157-166. Male right metacetaula: odd numbers: dorsal view; even numbers: dorsolateral view. – 157, 158, *Ventidius kuiterti*; 159, 160, *V. karen*; 161, 162, *V. sp.*, male, from Viet Nam; 163, 164, *V. pulai*; 165, 166, *V. lundbladi*.



Figs. 167-176. External view of parameres, odd numbers: right paramere (except 173: internal view), even numbers: left paramere (except 174: posterior view of right paramere). – 167, 168, *Ventidius kuiterti*; 169, 170, *V. karen*; 171-174, *V. pulai*; 175, 176, *V. lundbladi*.



Figs. 177-180. Lateral view of endosoma sclerites. – 177, *Ventidius kuiterti*; 178, *V. karen*; 179, *V. pulai*; 180, *V. lundbladi*. – Fig. 181. *V. karen*, ventral view of male 8th abdominal segment. – Fig. 182. *V. lundbladi*, dorsal view of male 7th abdominal tergite, showing the pilosity.

Redescription

Dimensions. – Apterous form, length 2.66 (♂), 3.17 (♀), width 1.72 (♂), 2.17 (♀), width of head 1.15 (♂), 1.30 (♀).

Colour (fig. 183). – Whole body predominantly yellowish dorsally, with dark marks. Eyes mainly dark brown to blackish, with brownish margins. Interoculus dark from dorsal view, with a thick M-shaped yellowish mark at its posterior margin, along inner margin of eye with a dark stripe. Antennal segments mainly blackish, but yellowish at basal 1/3 of segment 1, most part of the segment 3 and middle part of fourth segment; in female sometimes all antennal segments blackish except basal 1/3 of first segment yellowish. Pronotum blackish, lateroposterior angle with a very small yellowish mark. Mesonotum with broad lateral dark stripes, which are confluent with the lateral triangular blackish mark on metanotum. Metanotum also with a large triangular dark mark basomedially which is close to the anterior margin. Mesopleura yellowish without longitudinal stripe at anterior half (fig. 138); posterior margin of metapleura dark; upper external half and lower external half of metacetabula dark (figs. 159, 160). Fore leg dark, femur with basal 2/5 yellowish (fig. 149). Middle and hind legs dark. Tergites 1-2 blackish, 3-4 blackish with obscure yellowish mark in the middle, 5-6 dark laterally with a median yellowish mark, 7 yellowish, with posterior margin dark, 8 dark. Laterotergites and connexiva 1-5 blackish, 6-7 yellowish in male, predominantly yellowish with dark margins in female. Venter yellowish, male segment 8 ventrally dark (fig. 132).

Pilosity. – Inner surface of antennal segment 1 with 4 subbasal and 1 subdistal long spine, around segments 2-4 clothed with usual pubescence, also with longer setae and spinules. In male from distal half of segment 1, through all antennal segments with fine silvery hair fringe. Dorsum and pleura bearing dark pubescence. Long stiff spines scattered along middle and hind legs, tibia with shorter stiff spinules, inner surface of tarsal segment 1 of middle leg with a fringe of hairs (fig. 149). Basal part of middle and hind femora with two very long trichobothria-like seta on dorsal surface respectively, the external one shorter than the internal one. Ventrally clothed by golden pubescence, on genital segments the pilosity slightly longer and denser.

Structural characters. – Interoculus subequal to width of an eye, 0.39 : 0.36 in male, 0.46 : 0.42 in female, respectively. Antennae slender, segment 2 shorter than segment 3 (Measurements see table 1); segment 3 in male not modified at distal half (fig. 143). Pronotum not bulbous, mesonotum strongly swollen dorsally, its lateral width 1.04 (♂), 1.36 (♀). Mesosternal groove conspicuous, distally terminated by a small tubercle covered by short brown setae. Intersegmental su-

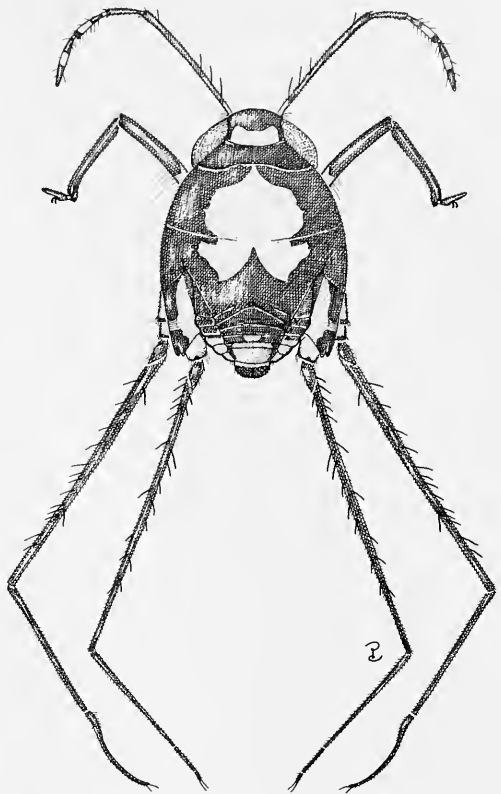


Fig. 183. *Ventidioides (Ventidioides) karen*, paratype, apterous male, length 2.66 mm.

ture between meso- and metanotum faint but visible. Metanotum somewhat declivent. Lower half of hind margin of metacetabula bilobate (figs. 159, 160). Metasternal tubercle not prominent in male. Fore femur slightly curved, ventral surface with a small tooth (fig. 149). Anterior margin of abdominal tergite 1 visible; anterior margins of tergites 2 and 3 faint, obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes. Laterotergites broad.

Male terminalia. – Parameres (figs. 171, 172) asymmetrical, both hooked at subbasal part, left paramere larger than right one, its apex twisted and blunt; right paramere bar-shaped with blunt apex; not extending beyond genital segments. Endosoma (figs. 178, 181): dorsal sclerite long and recurved proximally, ventral sclerite long, lateral sclerite straight, hooked at distal and broadened at proximal parts, second lateral sclerite long and thin, third lateral sclerites curved, apical sclerite indistinct.

Female terminalia. – Abdominal sternite 7 large,

broadly elevated medially, posterior margin slightly concave forward.

Macropterous form. – (According to Lansbury, pers. comm.) 3.60 mm long, maximum width 1.90 mm. colour pattern (fig. 131) pronotum black with two irregular yellowish blotches. Wings anteriorly black with fine pubescence and with scattered longer black hairs. Posterior membranous part of wings dark brown. The other morphological characters as in apterous form except the apex of pronotum pointed (measurements see table 3); length of fore wing from humeri to apex 2.60.

Distribution (map 4). – Thailand: Nakhon Ratchasima, Petchabun; Viet Nam: Gia Lai-Kontum.

Comparative notes. – *Ventidius karen* shares most characters with *V. kuiterti*, especially the short antennal segment 3, the yellowish bands on antennal segments 3 and 4, and the mesosternal groove ending with a small tubercle which is covered by dark setae. Main differences between these species are found in body length (*V. kuiterti* smaller than *V. karen*), in dorsal colour patterns of meso- and metanotum (in *V. kuiterti* darker than in *V. karen*), in relative lengths of antennal segment 3 and 4 (segment 4 longer in *V. karen*), and in male parameres (see figs. 169, 170). Furthermore, *V. karen* is the only species within the *V. kuiterti*-group, which has a third pair of endosoma lateral sclerites (see fig. 178).

Remarks. – One apterous female (figs. 139, 144, 150, 161, 162, 184) was collected from Viet Nam: : Prenn, 900 m, 15 km S of Da Lat, No. 294, 15.x.1988, leg. Vasarhej (TMBC). This specimen has been listed as a *Ventidius* (*Ventidioides*) sp. by Zettel & Chen (1996: 152, 181). As male specimens are lacking, it is difficult to decide its specific status. According to its aberrant appearance, we present the description below:

Dimensions. – apterous female: length 3.30, width 2.35, width of head 1.38.

Colour (fig. 184). – Whole body predominantly yellowish, with dark marks. Eyes mainly greyish. Interoculus yellowish with a broad blackish transversal mark, along inner margin of eye with a dark stripe. Antennal segments mainly blackish, but yellowish at basal 1/3 of the segment 1, distal half of the segment 3 and middle part of the segment 4 with a yellowish band respectively. Pronotum blackish, lateroposterior angle with a small yellowish mark, posterior margin with two small yellowish marks. Mesonotum yellowish without dark stripes. Metanotum with a triangular dark mark basomedially. Mesopleura yellowish with interrupted dark stripe (fig. 139). Anterior external half and posterior external angle of metacetabula dark (figs. 161, 162). Fore leg dark, femur with basal 2/5 yellowish (fig. 150). Middle and hind legs dark. Tergite 1 black in the middle, and yellowish laterally,

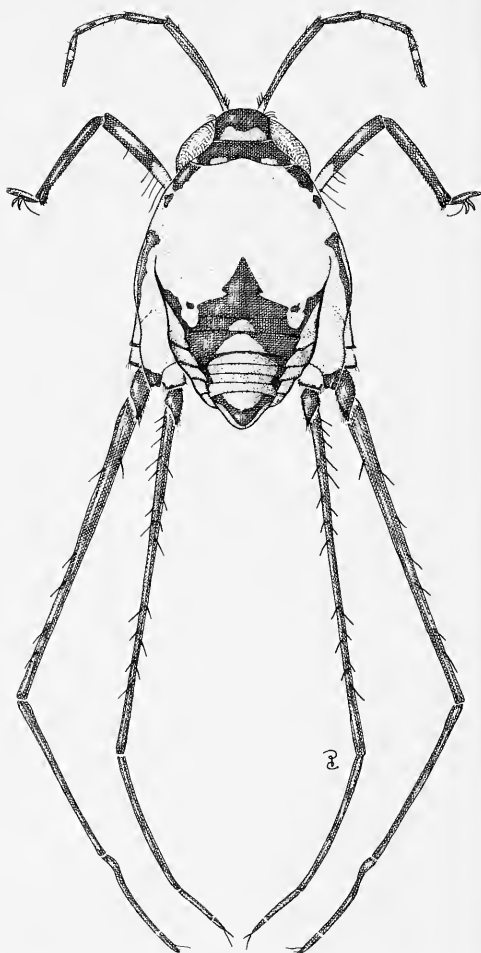
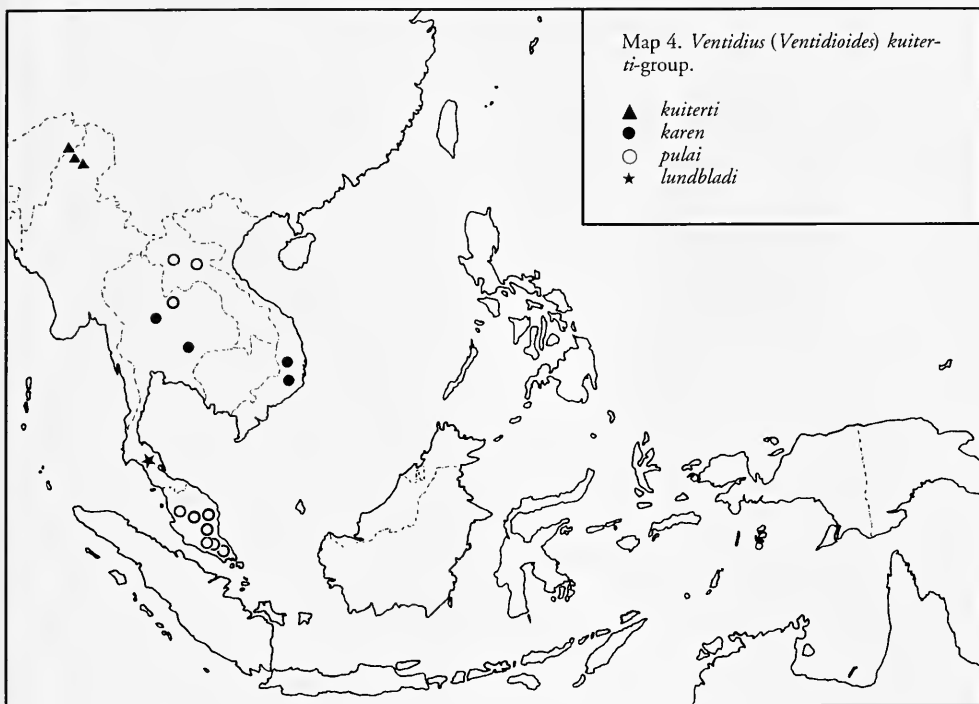


Fig. 184. *Ventidius* (*Ventidioides*) sp. from Viet Nam, apterous female, length 3.25 mm.

2-3 blackish with triangular yellowish mark in the middle, 4 yellowish with dark lateral and anterior margins, 5-6 and 8 yellowish with dark lateral margins, 7 completely yellowish. Laterotergites completely yellowish and connexiva 2-4 blackish, 5-7 yellowish. Venter yellowish.

Pilosity. – Inner surface of antennal segment 1 with 4 subbasal and 1 subapical long spines, around segments 2-4 clothed with usual pubescence, also with longer setae, especially on segment 4. Dorsum and pleura bearing dark pubescence. Long stiff spines scattered along middle and hind legs. Tibia with shorter stiff spinules.

Structural characters. – Interoculus broader than width of an eye, 0.52 : 0.42. Antennae slender, seg-



ment 2 shorter than segment 3 (fig.144) (measurements see table 1). Pronotum not bulbous, mesonotum strongly swollen dorsally, lateral width of mesothorax 1.40 (♀). Intersegmental suture between meso- and metanotum not visible. Metanotum somewhat declivent. Lower half of hind margin of metacatabula bilobate (figs. 161, 162). Fore femur slightly curved, ventral surface not modified (fig.150). Anterior margins of abdominal tergite 1-3 not visible.

Female terminalia. – Abdominal sternite 7 large, as long as the preceding abdominal sternites together, broadly elevated medially, posterior margin slightly concave forward.

Comparative notes. – This specimen is similar to *V. karen* in most characters. But differences are found in colour of pronotum, mesonotum, and abdominal tergites, which are much darker in *V. karen*. The thorax is much more bulbous than in *V. karen*. It is difficult to decide until the male specimen will be available. Although the specimen represents most likely a further species of the *V. kuiterti*-group, it is not impossible that it is a very aberrant female of *V. karen*.

16. *Ventidius pulai* Cheng
(figs. 133, 140, 145, 146, 151, 152, 155, 156, 163, 164, 171-174, 179, 185, map 4)

Ventidius pulai Cheng, 1965: 153-155, 163 (descr., illustr., key); Kovac & Yang 1989: 285 (rec.); Yang & Kovac 1995: 293 (rec.).

Type locality. – MALAYSIA: Johor.

Type material examined. – Holotype ♂, apt., allotype ♀, apt., and paratypes (3♂ 1♀ apt.): MALAYSIA: Johor, stream at Gunung Pulai, 500 m, 17.iii.1963, leg. L. Cheng (BMNH, ZRCS).

Other material examined. – MALAYSIA: 15♂, 25♀ apt., 3♂, 2♀ macr., Perak, stream 58 km S. of Grik, CL 2077, 19.viii.1985, J.T. & D.A. Polhemus (JTPC, NHMW); MALAYSIA: 1♀ apt., Perak, Kerunai River, 9 km N of Grik at bridge, CL 2078, 19.viii.1985, J.T. & D.A. Polhemus (JTPC); 1♂ 2♀ apt., 2♀ macr., Perak, Ipah Hill, stream nr. reservoir, 4.iii.1927 (BMNH, NHMW); 1♂ 1♀ apt., 1♀ macr., Perak, Sungai Batang Padang, nr. for. camp, 13.iii.1927, coll. Dover (BMNH); 3♀ apt., Selangor, Klang River, near Klang Gates, 21.viii.1926, coll. Dover (BMNH); 4♂ apt., Selangor, Ampang, waterworks, 5.ix.1926, coll. Dover (BMNH, ZMUC); 1♀ apt., same locality, 30.ii.1927 (BMNH); 2♂ 4♀ Selangor, Sungai Ampang, 5.ix.1926, coll. Dover (BMNH, NHMW, ZMUC); 6♂ 8♀ apt., same locality, 15.viii.1926, coll. Dover (BMNH, PPCC); 1♂ apt., same locality, 28.viii.1926, coll. Dover (BMNH); 24♂ 40♀ apt., 1♂ 1♀ macr., Selangor, Templer Park, CL 2070, 17.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW, PPCC); 1♂, 3♀ macr., Johor, Gunung Pulai, 26.ii.1961, leg. C.H. Fernando (SEMC); 7♀ apt., Johor, Endau, Sg. Anak Jasin, 4.iv.1992, L.186, leg. H.K. Lua (ZRCS, NHMW); 2♂ 2♀ apt., same locality data, leg. K.L. Yeo (ZRCS); 5♀ apt., Johor, S Taku,

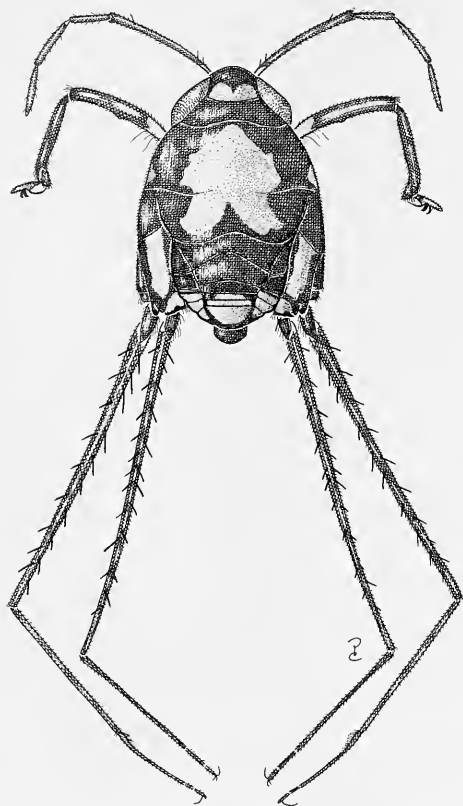


Fig. 185. *Ventidius (Ventidioides) pulai*, paratype, apterous male, length 2.63 mm.

18.vii.1989, K.L. Yeo (ZRCs); 1 ♀ apt., Johor, S Taku, 15.vi.1989, leg. C.M. Yang et al. (ZRCs); 1 ♀ macr., Negeri Sembilan, 10 km N Simpang Pertang, unnamed stream, 10.iv.1994, A-1063, leg. W.D. Shepard (NHMW); 1 ♂ 1 ♀ macr., Terengganu, Sg. Terengganu tributary, Sekayu, 16.v.1995, leg. Bruce Tan & Sumita, TG6 (ZRCs); 1 ♀ apt., Kelantan, Sungai Hulu Besut, 6 km (W?) after Kampung Keruah, on road to hydroelectric station, 20.iii.1992, L184, leg. H.K. Lua (ZRCs); 2 ♂ 5 ♀ apt., 1 ♀ macr., Pahang, S. Kinchin, 19.vii.1989, leg. K.L. Yeo & K.H. Lua (ZRCs, NHMW); 1 ♂ 3 ♀ apt., Pahang, S. Kernam, 19.vii.1989, K.L. Yeo (ZRCs); 3 ♂ 4 ♀ apt., 1 ♀ macr., Pahang, S. Kinchin, 13.vi.1989, leg. C.M. Yang et al. (ZRCs, PPCC); 3 ♂ 3 ♀ apt., 2 ♀ macr., Pahang, S. Seladang, 19.vii.1989, leg. K.L. Yeo (ZRCs, NHMW); 2 ♂ 3 ♀ apt., 8 larvae, Prov. 2, H.T. Pagden, BM 1959-236 (BMNH); LAOS: 1 ♂ 4 ♀, (Indo-China), Luang Prabang, Pak Lueng, 5.iii.1920, leg. R.v. de Salvaza, 1920-280 (BMNH, NHMW); 1 ♀ apt., Xieng Khouang, Sala Hat Samping, 17.xi.1917, leg. R.v. de Salvaza (BMNH); THAILAND: 1 ♂ 3 ♀ apt., Loei, Kaeng Hai, Nam San Khe, 9.iii.1994, A-1035, leg. W.D. Shepard (css, NHMW). 1 ♂ 1 ♀, apt. Chiang Mai, c. 10 km E Samoeng (18°51'N, 98°38'E), river, leg. W.G. Ullrich (Ullrich collection, NHMW)

Redescription

Dimensions. – Apterous form: length 2.63 (♂), 2.92 (♀), width 1.75 (♂), 2.00 (♀), width of head 1.20 (♂), 1.50 (♀).

Colour (fig. 185). – Whole body prominently dark, with distinct yellowish marks. Eye blackish. Interoculus blackish, with one large M-shaped yellowish mark at posterior margin. Antennal segments dark, except basal 1/5 of segment 1. Pronotum totally dark. Mesonotum dark with central triangular yellowish mark which is confluent with the yellowish mark of metanotum. Metanotum with a triangular dark mark basomedially and two oblique yellowish stripes laterally. Mesopleura yellowish, with a small dark mark anteriorly; anterior, external margin and lower part of metacetabula blackish (fig. 140). Metasternum dark. Fore leg dark with basal 1/5 yellowish (figs. 151, 152). Middle and hind legs dark. Tergites 1-4 completely dark, 5-6 blackish with a yellowish mark in the middle, 7 yellowish but dark laterally, 8 dark. Laterotergites 1-4 blackish, 5 dark with a fine yellowish mark, 6-7 yellowish. Connexiva 1-5 dark, 6-7 yellowish. Sternite 7 dark laterally, segment 8 ventrally dark in male.

Pilosity. – Inner surface of antennal segment 1 with 4 subbasal and 1 subapical spines, in males through basal half of segment 1 to segment 4 with silvery fine hair fringe; segments 2-4 with scattered brownish short setae (figs. 145, 146). Dorsal side, pleura, and acetabula clothed with dark pubescence. Dark setae prominent at subdistal part along inner surface of fore tibia. Venter clothed by golden pubescence, especially on genital segments the pilosity longer and denser. Venter yellowish, the setae on mesosternal tubercle dark brown. Long stiff spines scattered along middle and hind legs, denser than usual in the genus.

Structural characters. – Interoculus broader than width of an eye, 0.44 : 0.41 in male, 0.50 : 0.41 in female. Antennal segment 3 subequal to segment 4 (measurements see table 1) (fig. 145, 146). Thorax not bulbous, mesonotum somewhat swollen, its lateral width 1.10 (♂), 1.45 (♀). Intersegmental suture between meso- and metanotum obscure. Metanotum somewhat declivent. Lower part of metacetabula bilobate (figs. 163, 164). Fore femur slightly incrassate, halfway its inner surface with a small tooth (fig. 151), claw rising from 2/5 of segment 2 of fore tarsus. Fore leg of female see fig. 152. Anterior margin of abdominal tergite 1 obscure, anterior margins of tergites 2 and 3 obscure but eventually obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes. Laterotergites broad.

Male terminalia. – Parameres (figs. 171-174) asymmetrical, stout, curved at basal part, left paramere distinctly longer than right one, its apical part curved upwards, with blunt apex; apical part of right paramere

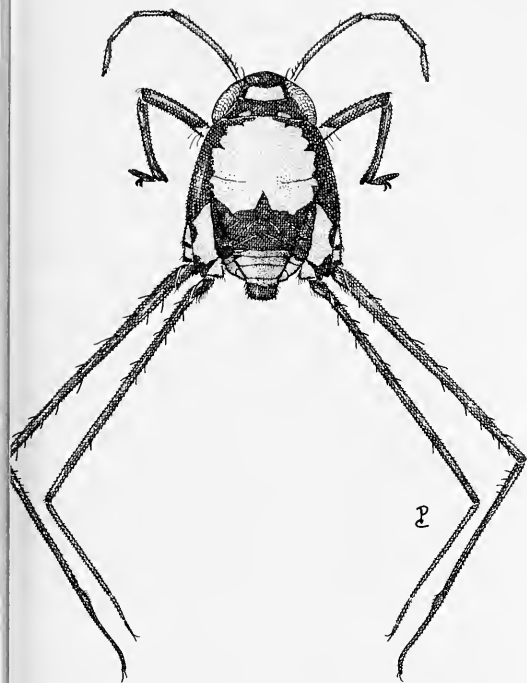


Fig. 186. *Ventidius (Ventidioides) lundbladi*, apterous male, length 2.37 mm.

straight and pointed upwards, with blunt apex; the left paramere extending beyond genital segments. Endosoma (fig. 179): dorsal sclerite long and recurved proximally, ventral sclerite long, lateral sclerites straight, broadened at two ends, second lateral sclerites thin and weak.

Female terminalia. – Abdominal sternite 7 large, posterior margin smooth, concave forwards.

Macropterous form. – Maximum width 1.66 mm. colour pattern: Pronotum black with two regular yellowish marks (fig. 133); wings black anteriorly with fine pubescence and with scattered longer black hairs; posterior membranous part of wings dark brown (figs. 155, 156). Other morphological characters as in apterous form except the apex of pronotum pointed (measurements see table 3).

Distribution (map 4). – Thailand: Loei; Laos; Malaysia: Perak, Johor, Selangor, Pahang, Kelantan, Negeri Sembilan, Terengganu.

Comparative notes. – Typical member of the *V. kuiterti*-group, and easy to distinguish from *V. kuiterti* and *V. karen* by subequal and uniformly brown antennal segments 3 and 4 in the male, and a less developed blotch of dark setae on mesosternum. The left paramere is apically twisted (fig. 174) similar as in *V. karen* (fig. 170), but less curved. The shape of para-

meres, a usually darker colouration, and a less developed pilosity of segment 8 of males are the main differences to *V. lundbladi* (see under comparative notes of that species).

17. *Ventidius (Ventidioides) lundbladi* Miyamoto (figs. 134, 141, 147, 153, 154, 165, 166, 174-176, 180, 182, 186, map 4)

Ventidius lundbladi Miyamoto, 1967: 245-247 (descr., illustr.).
Type locality. – THAILAND: Khao Chong.

Material examined. – THAILAND: 8 ♂ 11 ♀ apt., S. Banna, Nakhon, 108 m, 5-10.v.1958, leg. T.C. Maa, No. 415 (BIMC, JTPC, NHMW, PPCC).

Redescription

Dimensions. – Apterous form. Length 2.37 (♂), 2.60 (♀), width 1.57 (♂), 1.88 (♀), width of head 1.04 (♂), 1.11 (♀).

Colour (fig. 186). – Whole body prominently dark, with distinct yellowish marks. Eye blackish. Interoculus pale, with one large heart-shaped dark mark, the dark mark along inner margin of eye reaching posterior margin of vertex, and connected with the heart-shaped one. Antennal segments dark, except basal 2/5 of segment 1. Pronotum usually completely dark, in some specimens with two small yellowish marks at the lateroposterior margin of pronotum. Mesonotum with lateral dark mark. Metanotum with triangular dark mark. Mesopleura yellowish (fig. 141); external angle of metacubula dark (figs. 165, 166). Under strong light, along the intersegmental suture between metanotum and tergite 1, the pubescence reflects with a shining greenish metallic colour. Fore leg dark with basal 1/3 yellowish (figs. 153, 154). Middle and hind legs dark. Tergites 1-4 completely dark, 5 yellowish with lateral dark mark, 6-7 yellowish, 8 dark. Laterotergites 1-4 dark, 5 dark basally, 6-7 yellowish. Connexiva 1-5 dark, 6-7 yellowish. Venter yellowish.

Pilosity. – Trichobothria prominent (fig. 134) Inner surface of antennal segment 1 with 3 subbasal, and 1 subapical long spines; in males through basal half of segment 1 to apical half of segment 4 with silvery fine hair fringe; segments 2-4 with scattered dark short setae (fig. 147). Dorsum and pleura clothed with dark pubescence on yellowish marks, and golden pubescence on dark parts. Venter clothed by golden pubescence, especially on genital segments, the pilosity very long and dense. Long stiff spines scattered along middle and hind legs. Basal part of middle femur with a very long trichobothria-like seta on dorsal surface.

Structural characters. – Interoculus subequal to width of an eye, 0.40 : 0.32 in male, 0.40 : 0.35 in female. Antennal segment 3 subequal to segment 4

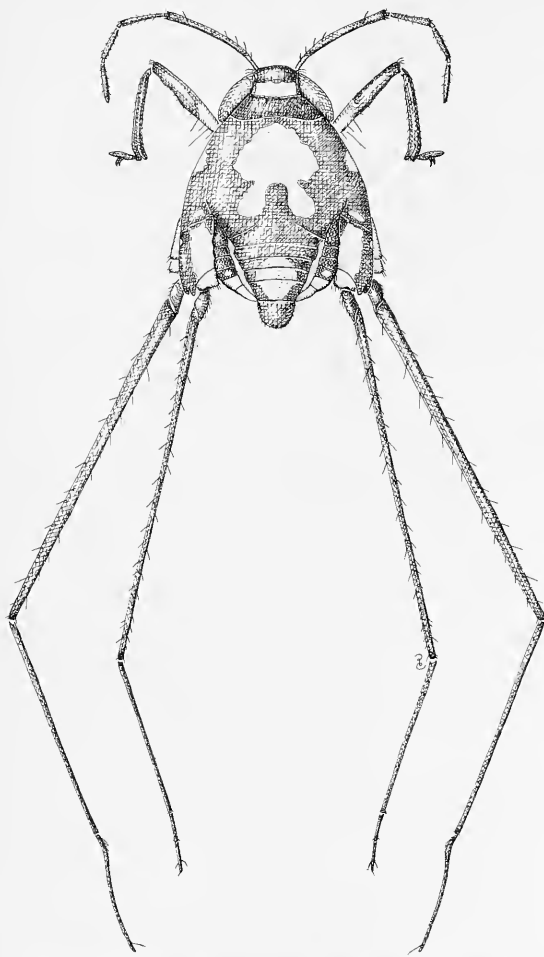


Fig. 187. *Ventidius (Ventidioides) xyele*, paratype, apterous male, length 2.95 mm.

(measurements see table 1) (fig. 147). Thorax not bulbous, mesonotum somewhat swollen, its lateral width 1.00 (♂), 1.33 (♀). Intersegmental suture between meso- and metanotum distinct. Metanotum somewhat declivent. Lower part of metacetabula bilobate (figs. 165, 166). Metasternal tubercle prominent in male. Fore femur slender and with a small tooth antero-ventrally, claw rising from 2/5 of segment 2 of fore tarsus. Anterior margin of abdominal tergite 1 distinct; anterior margins of tergites 2 and 3 obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes. Laterotergites broad.

Male terminalia. – Parameres (fig. 175, 176) asymmetrical, both hook-shaped, left paramere longer than right one, its apex sharp and pointed forward,

distal part of right paramere straight upwards, with blunt apex; both parameres extending beyond genital segments. Endosoma (fig. 180): dorsal sclerite long and curved proximally, ventral sclerite long, lateral sclerite straight, broadened at distal part, second lateral sclerites thin and weak, apical sclerite indistinct.

Female terminalia. – Abdominal sternite 7 large, posterior margin smooth, concave forwards.

Macropterous form. – Unknown.

Distribution (map 4). – Thailand: S. Banna, Khao Chong.

Comparative notes. – Although the types were not available for our study, there is no doubt about this species which is characterized by the shape of parameres figured by Miyamoto (1967: figs. 73-74). It is most similar to *V. pulai*, but easily distinguishable by the shape of parameres: left paramere (fig. 174) long and slender in distal part, not plate-like and apically not twisted as in *V. pulai*; right paramere as in fig. 175. The dense developed long dark pilosity on segment 8 of male (fig. 182) richer than in *V. pulai*; Both sexes are also different in the thoracic colour pattern, which is usually much darker in *V. pulai*.

The *Ventidius xiphibion*-group

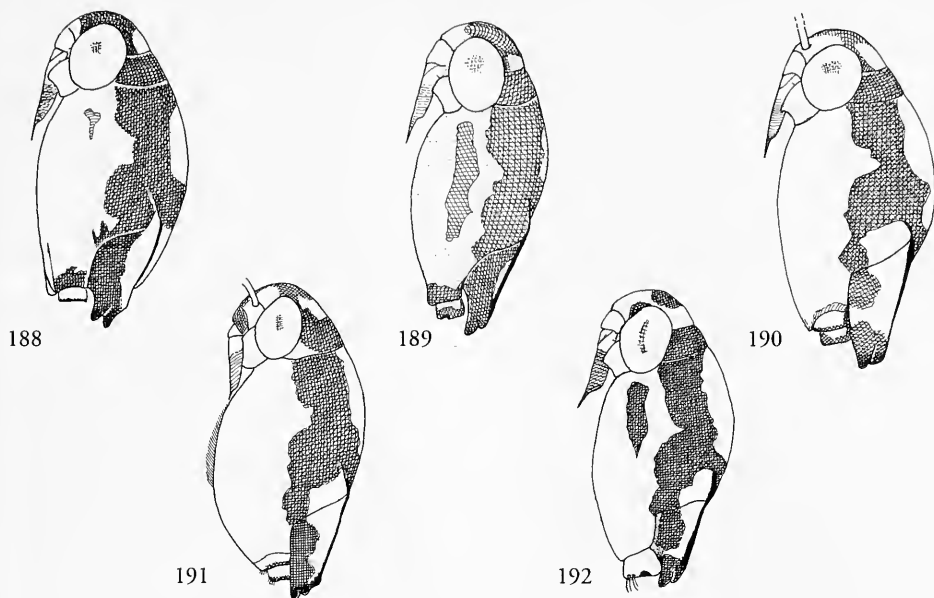
Diagnosis. – Prominent dark colouration; male fore femur without sharp tooth; most species with modified male fore leg, two species with a thickening on fore tibia, other species with tuft of black setae on fore trochanter, one species (*V. heissi* sp. n.) without both of these characters; mesosternum with a patch of dark setae along median mesosternal groove; parameres protruding beyond genital segments, larger than in other *Ventidius* species, more or less asymmetrical; endosoma with distinct third pair of lateral sclerites, in most species with distinct apical accessory sclerite.

Notes. – This group includes five species, two from Sulawesi and three from Borneo. The Sulawesi species are characterized by a tuft of black setae on male fore trochanter and by asymmetrical parameres, which are strongly enlarged basally. Two of the Bornean species are characterized by a modified male fore tibia, which is thickened and with dense short pilosity in middle of its length, by a distinct swelling of male fore femur, and by less asymmetrical, hooked parameres. *Ventidius heissi* sp. n. is regarded as related to these species by the general characters of male genitalia.

Distribution (map 5). – Borneo and Indonesia: Sulawesi.

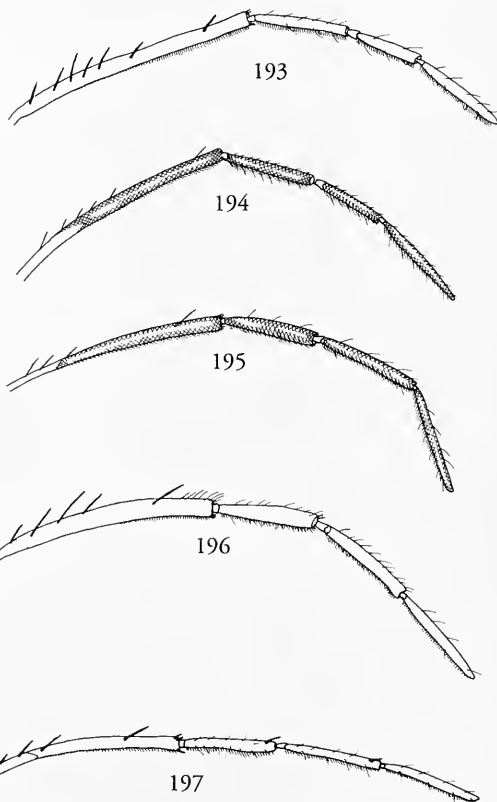
18. *Ventidius (Ventidioides) xiphibion* Chen & Nieser (figs. 188, 193, 198, 203, 204, 213, 216, 219, 220, 229, 230, map 5)

Ventidius xiphibion Chen & Nieser, 1992: 156-157 (descr., illustr.).



Figs. 188-192. Lateral view of apterous male, showing the colour pattern of pleura. – 188, *Ventidius xiphobion*; 189, *V. xyle*; 190, *V. kurtokalami*; 191, *V. nieseri*; 192, *V. heissi*.

Figs. 193-197. Dorsal view of male right antennae. – 193, *Ventidius xiphobion*; 194, *V. xyle*; 195, *V. kurtokalami*; 196, *V. nieseri*; 197, *V. heissi*.



Type locality. – INDONESIA: Sulawesi.

Type material examined. – Holotype ♂, apt., allotype ♀ apt., INDONESIA: Sulawesi Tenggara Prov., small stream 8 km E of Sungai Sampara along road Kendari-Wawotobi, N8911, 22.ii.1989, leg. N. Nieser (RMNH); Paratypes: 41 ♂, 64 ♀, apt., 1 ♂ macr., same locality data as holotype (RMNH, NCTN, PPCC, NHMW); 35 ♂ 39 ♀, apt., 1 ♀ macr., Sulawesi Tenggara Prov., P. Buton, stream just N of Bau-bau, N8925, 8.iii.1989, leg. N. Nieser (RMNH, NCTN, NHMW); 40 ♂ 17 ♀ apt., 1 ♀ macr., Sulawesi Tenggara Prov., stream about 15 km E of Bau-bau, N8942, 10.iii.1989, leg. N. Nieser (RMNH, NCTN).

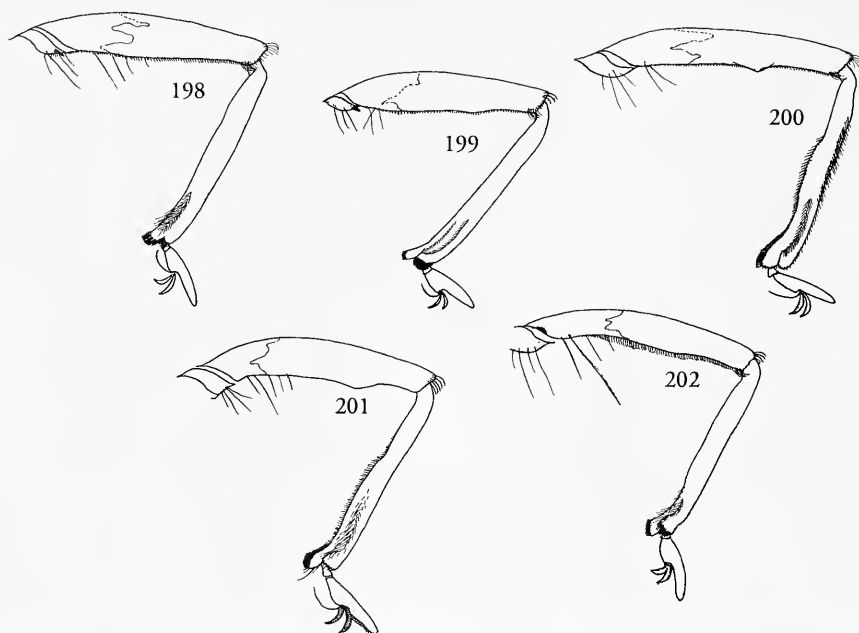
Other material examined. – 1 ♂ 1 ♀ apt., Sulawesi Tengah Prov., Ampana, 31.1.1995, leg. Seyfert & Graindl (49) (NHMW).

Locality notes. – Small to medium sized streams with turbid water due to suspended loam. The species tends to aggregate in places with little current.

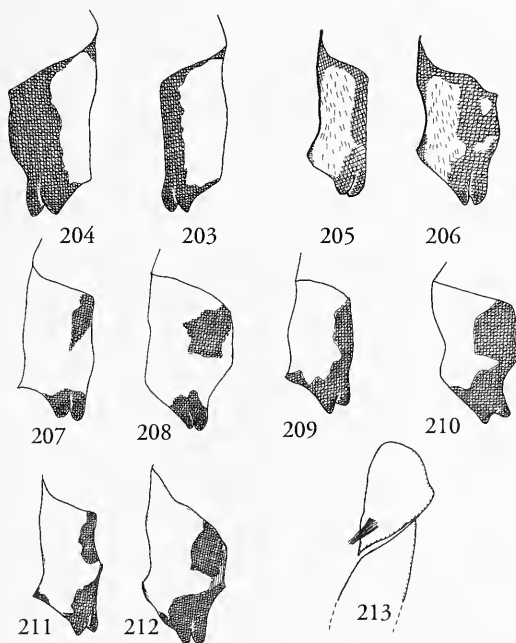
Redescription

Dimensions. – Apterous form. Length 2.90 (♂), 3.15 (♀), width 2.00 (♂), 2.26 (♀), width of head 1.28 (♂), 1.28 (♀).

Colour. – Whole body prominently dark, with distinct yellowish marks. Eye brownish. Interoculus



Figs. 198-202. Dorsal view of right fore leg. — 198, *Ventidius xiphibion*; 199, *V. xyle*; 200, *V. kurtokalami*; 201, *V. nieseri*; 202, *V. beissi*.

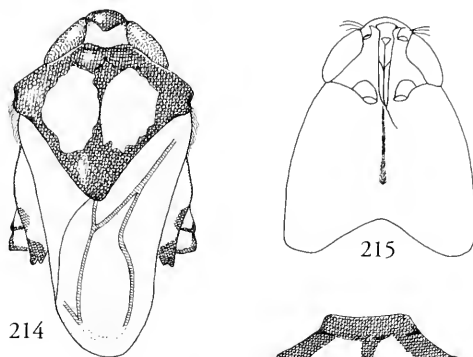


Figs. 203-212. Metacetaula, odd numbers: dorsal view, even numbers: dorsolateral view. — 203, 204, *Ventidius xiphibion*; 205, 206, *V. xyle*; 207, 208, *V. kurtokalami*; 209, 210, *V. nieseri*; 211, 212, *V. beissi*. — Fig. 213. *V. xyle*, ventral view of fore trochanter, showing the tuft of dark setae.

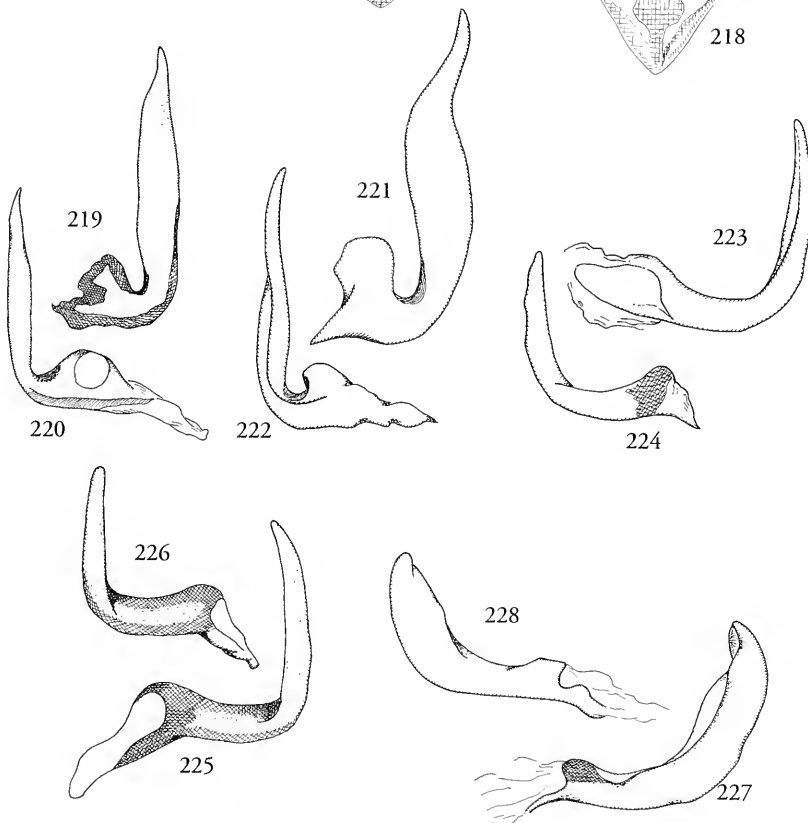
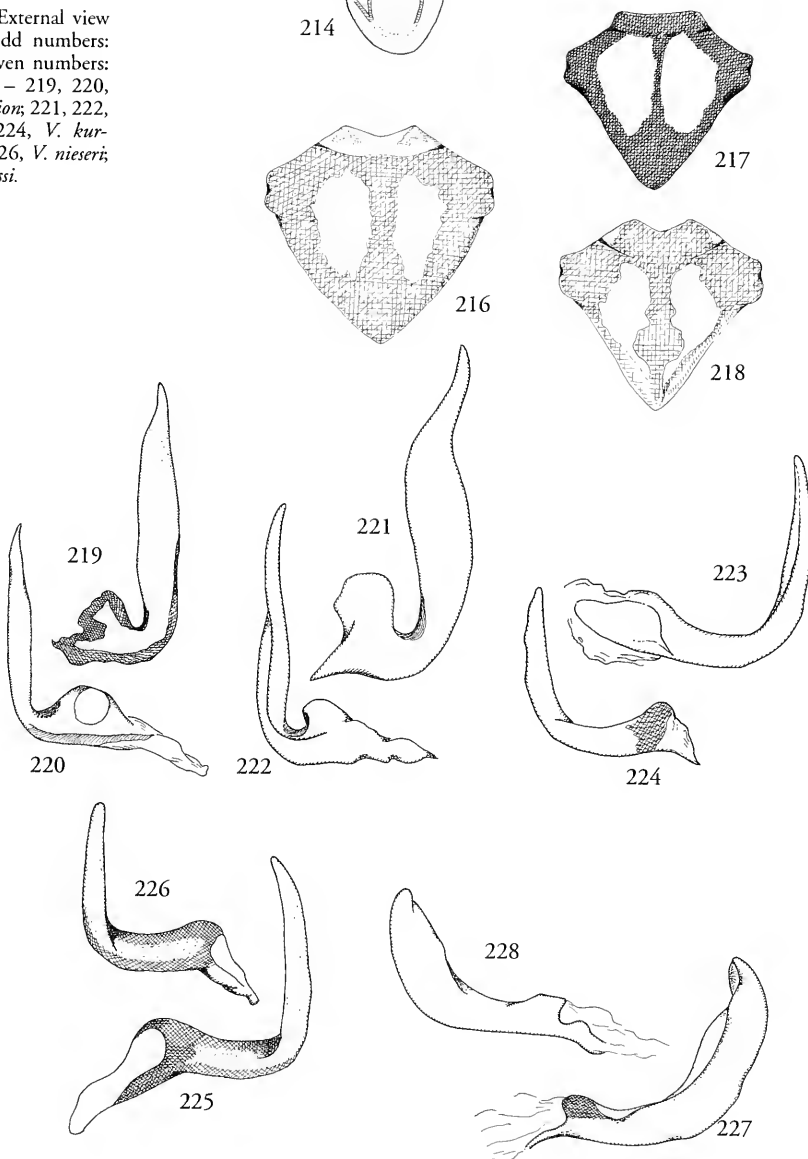
blackish, with one large M-shaped yellowish mark at posterior margin. Antennal segments dark, except basal 2/5 of segment 1. Pronotum dark in male, in some specimens with a small central yellowish mark; in female dark, with a central and two small yellowish marks at the lateroposterior margin, in some specimens the posterior margin with faint yellowish marks. Mesonotum yellowish with broad lateral dark stripe which is confluent with the dark mark of metanotum. Metanotum blackish with two oblique yellowish marks. Mesopleura yellowish, with a small black mark near anterior margin in male (fig. 188), with a brownish stripe running through its length in female, but in some specimens the dark marks are obscure. External half of metacetaula blackish (figs. 203, 204). Fore leg dark with basal 1/2 yellowish (fig. 198). Middle and hind legs dark. Tergites 1-4 completely dark, 5 blackish with a triangular yellowish mark in the middle, 6-7 yellowish with lateral and posterior margin dark, 8 dark. Laterotergites 1-2 blackish, 3-7 yellowish. Connexiva 1-4 dark, 5-7 yellowish. In female the colouration of abdomen paler than in males. Venter yellowish.

Pilosity. — Inner surface of antennal segment 1 with 6-8 subbasal and 1 subapical spines, through basal half of segment 1 to segment 4 with fine silvery hair fringe; segments 2-4 with scattered brownish short setae (fig. 193). Dorsum, pleura and metacetaula bearing dark pubescence. Ventral surface of fore trochanter with a tuft of dark setae apically (fig. 213).

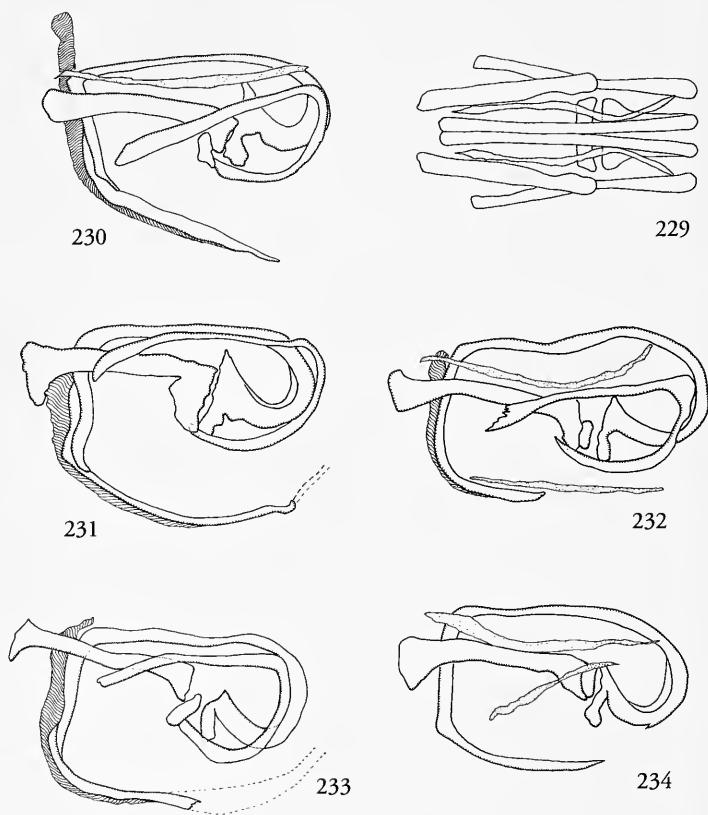
Figs 214-218. — 214, *Ventidius kurtokalami*, dorsal view of macropterous female (appendages removed); 215, *V. nieseri*, ventral view of body, showing the patch of dark mesosternal setae; 216-218, dorsal view of macropterous pronotum. — 216, *V. xiphobion*; 217, *V. nieseri*; 218, *V. xylele*.



Figs. 219-228, External view of parameres, odd numbers: left paramere, even numbers: right paramere. — 219, 220, *Ventidius xiphobion*; 221, 222, *V. xylele*; 223, 224, *V. kurtokalami*; 225, 226, *V. nieseri*; 227, 228, *V. heissi*.



Figs. 229-234. – 229, *Ventidius xiphibion*, dorsal view of endosoma sclerites. – 230-234. Lateral view of endosoma sclerites. – 230, *V. xiphibion*; 231, *V. xyle*; 232, *V. kurtokalamä*; 233, *V. nieseri*; 234, *V. heissi*



Dark setae along inner surface of fore tibia not modified (fig. 198). Venter clothed by golden pubescence, especially on genital segments the pilosity longer and denser. On half way of mesosternal groove with a blotch of dark setae which is displayed in two longitudinal lines. Stiff spines scattered along middle and hind legs.

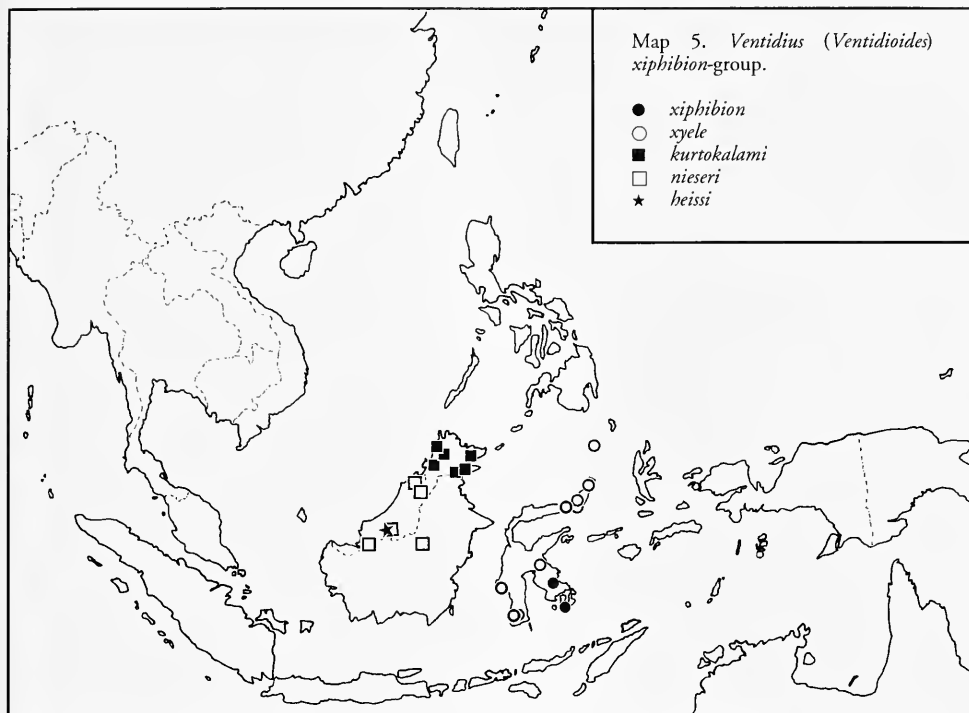
Structural characters. – Interoculus broader than width of an eye, 0.47 : 0.40 in male, 0.47 : 0.42 in female. Antennae not modified, measurements see table 1 (fig. 193). Thorax not bulbous, mesonotum somewhat swollen, its lateral width 1.17 (♂), 1.35 (♀). Intersegmental suture between meso- and metanotum distinct. Metanotum somewhat declivent. Lower part of metacetaula bilobate (figs. 203, 204). Metasternal tubercle not prominent. Fore femur incrassate, tapering towards distal part (fig. 198), claw rising from 1/3 of segment 2 of fore tarsus. Anterior margin of abdominal tergite 1 obscure but visible, anterior margins of tergites 2 and 3 obscure but eventually obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes. Laterotergites broad.

Male terminalia. – Parameres (figs. 219, 220) asymmetrical, both hooked, left paramere longer and broader than right one, knife-shaped, tapering distally, with sharp apex. Right paramere slender and with blunt apex. Endosoma (figs. 229, 230): dorsal sclerite long and recurved proximally, ventral sclerites long and weak, lateral sclerites straight, broadened at two ends, second lateral sclerites thin and weak, third lateral sclerites distinct and curved; apical accessory sclerite distinct.

Female terminalia. – Abdominal sternite 7 large, posterior margin smooth, concave forwards.

Macropterous form. – Maximum width 1.75 mm. Colour pattern: pronotum (fig. 216) black with two regular yellowish blotches. Wings anteriorly black with fine pubescence and with scattered longer black hairs. Posterior membranous part of wings dark brown. The other morphological characters as apterous form except the apex of pronotum pointed (measurements see table 3); length of fore wings from humeri to apex 2.40.

Distribution (map 5). – Indonesia: Sulawesi Tenggara Prov., Sulawesi Tengah Prov.



Comparative notes. — Most characters of this species are similar to that of *V. xyele*, especially the less modified male fore leg, the shape of left and right parameres which are hooked upward close to a strongly enlarged base and very asymmetrical (left paramere much broader than right one). These characters unite both Sulawesi species and separate them from the Bornean species of the *V. xiphibion*-group. Differences between *V. xiphibion* and *V. xyele* are found in the extensive yellow pattern (much darker in *V. xyele*) and different shapes of male parameres: parameres of *V. xyele* have very slender and sharp apex (fig. 221, 222), in *V. xiphibion* the apex is not so sharply constricted (fig. 219, 220). The endosoma of *V. xiphibion* has a distinct apical accessory sclerite which is less prominent in *V. xyele*, but clearly present in the Bornean species of the subgenus.

19. *Ventidioidius (Ventidioidius) xyele* Chen & Nieser
(figs. 187, 189, 194, 199, 205, 206, 218, 221, 222, 231, map 5)

Ventidioidius xyele Chen & Nieser, 1992: 157–158 (descr. & illustr.).

Type locality. — INDONESIA: Sulawesi.

Type material examined. — Holotype ♂, apt., allotype ♀

apt., INDONESIA: Sulawesi Utara Prov., Dumoga Bone National Park, R. Toraut, Maze, 16.xi.1985, leg. G. Zimmermann (RMNH). Paratypes: 3♂ 9♀ apt., same locality data as holotype (RMNH, ZMAC, NCTN). 1♂ 1♀ apt., Dumoga Bone National Park, Base camp, 16.x.1986; 1♀, Dumoga Bone River, downstream, of bridge, 22.x.1985; 8♂ 9♀, apt., Tumpah River, Beach, 19.1985; 7♂ 7♀, apt., Tumpah River, Staustufe (low barrier), 23.x.1985; 3♂ apt., 2♂ 1♀ macr., Malibagu Z. 8.xi.1985; 4♂ 5♀, apt., Südküste, Strasse, Bach (S. coast, road, rivulet), 18.xi.1985. (deposited separately in ZCWA, NCTN, BPUH, JTPC, MBBJ, PPCC, ZMAC, ZMUC).

Other material examined. — INDONESIA: 1♂ 10♀ apt., Sulawesi Utara Prov., P. Sangihe, Naha, Sungai Laine at last bridge upstream, N9456, 27.vi.1994 (NCTN); 12♂ 9♀ apt., 1♀ macr., Sulawesi Utara Prov., P. Sangihe, D. Simuang (dekar di Malahu), Sungai Simuang, N9457, 28.vi.1994, leg. N. Nieser, mountain stream water clear, hyacin, boulders, stones, stretches with sand (NCTN); 20♂ 15♀ apt., Sulawesi Utara Prov., P. Sangihe, Desa Laine, Sungai Laine (different from N9454/56 which is on the other side of the island); pothole as water fall, 12.xi.1994, N9463, leg. N. Nieser (NCTN); 5♂ 12♀ apt., Sulawesi Utara Prov., P. Sangihe, small stream at Kampung Lapango-Hakadele (near desa Sawaeng), 18.xi.1994, N9474, leg. N. Nieser (NCTN); 9♂ 8♀ apt., Sulawesi Utara Prov., P. Sangihe, Desa Laine, Sungai Laine, near the road, 18.xi.1994, N9476, leg. N. Nieser, muddy pebbles between boulders, depth about 1 m, quiet flow of water, except for some shallow banks with rifles (NCTN); 9♂ 6♀ apt., Sulawesi Utara Prov., P. Sangihe, Sungai Miulu, 20.xi.1994, N9480, leg. N. Nieser (NCTN); 27♂ 39♀ apt., Sulawesi Utara Prov., P. Sangihe, desa Utau-rano, Sungai Apunukang, pothole, 14.xi.1994, N9465A,

leg. N. Nieser (NCTN); 2♂ 4♀, apt., Sulawesi Selatan Prov., E side Lake Matana, Kg. Salura: Nightjar Camp, 520 m, 13.x.1993, open water and among mangrove vegetation, 2°32'15"S. 121°28'00"E., leg. J.P. & M.J. Duffels (ZMAC); 2♂ 5♀, apt., same locality data as above, 450 m, 20.x.1993, narrow tributary to Lake Matana, 2°32'S., 121°28'E., J.P. & M.J. Duffels (ZMAC); 1♂ 2♀, apt., SW Sulawesi Selatan Prov., Onang, Sg. Parabaya, 58 km N of Majene, 19.xi.1993, strongly disturbed rain forest, leg. J.P. & M.J. Duffels (ZMAC); 4♂ 7♀ apt., 1♂ macr., Sulawesi Utara Prov., cave spring and stream at Komangaan, NW Kotamobagu, CL 2120, 14.ix.1985, leg. D.A. Polhemus (JTPC, NHMW); 11♂ 37♀ apt., 1♀ macr., Sulawesi Utara Prov., Tondano River tributary, S of Airmadidi, CL 2127, 20.ix.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 49♂ 42♀ apt., 1♂ macr., Sulawesi Utara Prov., tributary to Tumpah River, CL 2101, 4.ix.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW, PCC); 5♂ 4♀ apt., Sulawesi Utara Prov., Pononontuna River at Tapakulintang, 200 m, CL 2121, 15.ix.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 33♂ 38♀ apt., Sulawesi Utara Prov., Tumpah River, Dumoga-Bone Nat. Park, 0°34'N, 123°54'E, CL 2100, 4.ix.1985, 222 m, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 18♂ 28♀ apt, 1♀ macr., Sulawesi Utara Province, stream near Manembonembo, E of Manado, CL 2128, 20.ix.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 8♂ 16♀ apt., 1♀ macr., Sulawesi Selatan Prov., Patrunuang River, 7 km SW of Bantimurung, 0-100 m, CL 2165, 13.x.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 2♂ 5♀ apt., Sulawesi Selatan Province, Marana River, nr. Camba, 50 km E of Maros, 450 m, CL 2167, 14.x.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW).

Redescription

Dimensions. – Apterous form: Length 2.95 (♂), 3.10 (♀), width 2.06 (♂), 2.26 (♀), width of head 1.18 (♂), 1.21 (♀).

Colour (fig. 187). – Whole body prominently dark, with distinct yellowish marks. Eye blackish. Interoculus blackish, with one large M-shaped yellowish mark at posterior margin. Antennal segments dark, except basal ¼ of segment 1. Pronotum dark in male, in female lateroposterior margin with a small yellowish mark. Mesonotum yellowish with broad dark lateral stripes which are confluent with the dark mark of metanotum. Metanotum blackish with two oblique yellowish marks. Mesopleura yellowish, with a longitudinal dark stripe in male (fig. 189), in female this dark stripe less developed. External half of metacetabula blackish (figs. 205, 206). Fore leg dark with basal ½ (♂) (fig. 199) or ½ (♀) of femur yellowish. Middle and hind legs dark. Tergites 1-4 completely dark, 5-7 blackish with yellowish mark in the middle. Laterotergites 1-3 blackish, 4 blackish with yellowish mark, 5-7 yellowish. Connexiva 1-4 blackish, 5-7 yellowish. Venter yellowish. Segment 8 darkened ventrolaterally.

Pilosity. – Inner surface of antennal segment 1 with 5-6 subbasal and 1 subapical spines, through basal half of segment 1 to segment 4 with fine silvery hair fringe; segments 2-4 with scattered brownish short se-

tae (fig. 194). Dorsum and pleura and metacetabula bearing dark pubescence. Ventral surface of fore trochanter with a tuft of dark setae apically (fig. 213). Dark setae along inner surface of fore tibia not modified (fig. 199). Venter clothed by golden pubescence, especially on genital segments, the pilosity longer and denser. Halfway the mesosternal groove with a dark setae blotch which is displayed in two longitudinal lines. Stiff spines scattered along middle and hind legs, denser than in most other species.

Structural characters. – Interoculus broader than width of an eye, 0.49 : 0.41 in male, 0.50 : 0.44 in female. Antennae not modified, measurements see table 1 (fig. 194). Thorax not bulbous, mesonotum somewhat swollen, its lateral width 1.12 (♂), 1.27 (♀). Intersegmental suture between meso- and metanotum obscure. Metanotum somewhat declivent. Lower part of metacetabula bilobate (figs. 205, 206). Metasternal tubercle not prominent. Fore femur of male incrassate, tapering towards distal part (fig. 199). Claw rising from basal ⅓ of segment 2 of fore tarsus. Anterior margin of abdominal tergite 1 obscure but visible, anterior margins of tergites 2 and 3 obscure but eventually obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes. Laterotergites broad.

Male terminalia. – Parameres (figs. 221, 222) asymmetrical, both hooked, left paramere longer and broader than right one, knife-shaped, tapering distally, with sharp apex. Right paramere slender and with sharp apex. Endosoma (fig. 231): dorsal sclerite long and recurved proximally, ventral sclerites long and weak, lateral sclerites straight, broadened at both ends, second lateral sclerites thin and weak, third lateral sclerite long and curved, apical accessory sclerite small, not visible from lateral view.

Female terminalia. – Abdominal sternite 7 large, posterior margin smooth, concave forwards.

Macropterous form. – Maximum width 1.70 mm. colour pattern: pronotum (fig. 218) black with two regular yellowish blotches. Wings anteriorly black with fine pubescence and with scattered longer black hairs. Posterior membranous part of wings dark brown. Other characters as apterous form except the apex of pronotum pointed (measurements see table 3); length of fore wings from humeri to apex 2.30.

Distribution (map 5). – Indonesia: Sulawesi Utara Prov., Sulawesi Selatan Prov.

Comparative notes. – Most closely related to *V. xiphibion*; for difference see the comparative notes under that species.

20. *Ventidioides (Ventidioides) kurtokalami* Chen & Nieser
(figs. 190, 195, 200, 214, 223, 224, 232, 235, map 5)

Ventidiidius (Ventidioides) kurtokalami Chen & Nieser, 1992: 158-159 (descrip. & illustr.).

Type locality. — MALAYSIA: Sabah, Danum Valley.

Type material examined. — Holotype ♂, apt., allotype ♀, apt., E. MALAYSIA: Sabah, Danum Valley, 70 km W Lahad Datu, 4 km S main trail W5 nr. Sungai Segama, 150 m, middle sized stream and waterfall, 3.xii.1989, sample Sab. 54, M.J. & J.P. Duffels (ZMAC). Paratype: 1 ♂ apt., Sabah, Danum Valley, 70 km W Lahad Datu, main trail W 12, 180 m, narrow creek, 2.xii.1989, sample Sab. 52, M.J. & J.P. Duffels (NCTN).

Other material examined. — MALAYSIA: 15 ♂ 22 ♀ apt., 1 ♂ macr., Sabah, Danum Valley, Palum Tambun, 2.-13.2.1997, leg. H. Zettel (2) and leg. Zettel et al. (different project numbers) (UMSM, SPCM, NHMW); 3 ♂ 5 ♀ Sabah, Danum Valley, Sapat Kalisan, 12.2.1997, leg. H. Zettel (15) (UMSM, NHMW); 8 ♂ 11 ♀ apt. Sabah, Danum Valley, Waterfall, 3.2.1997, leg. H. Zettel (5) (UMSM, NHMW); 5 ♂ 6 ♀ apt., Sabah, Danum Valley, Water Pool, 11.2.1997, leg. H. Zettel (13) (UMSM, NHMW); 11 ♂ 3 ♀ apt., Sabah, North Borneo (SE), Forest Camp, 19 km N of Kalabakan, 12.xi.1962, leg. Y. Hirashima (BIMC, NHMW); 5 ♂ 10 ♀ apt., from same locality, 13.xi.1962 (BIMC, PPEC); 5 ♂ 2 ♀ apt., Sabah, North Borneo, Tawau, Quoin Hill, Forest Camp, 1,3-5 km WSW of Cocoa Res. Sta., 9.-20.viii.1962, leg. Y. Hirashima (BIMC, NHMW); 2 ♀ apt., Sabah, North Borneo, Tawau, Quoin Hill, Cocoa Res. Sta., 26.ix.1962, leg. Y. Hirashima (BIMC); 1 ♂ 2 ♀ apt., Sabah, British North Borneo, Tawau, Quoin Hill, 26.-29.vii.1962 (BIMC); 1 ♂ 1 ♀ apt., Sabah, Samlang River, 7 km S of Ranau, CL 2026, 3.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); 5 ♂ 7 ♀ apt., 1 ♂ 1 ♀ macr., Sabah, 40 km NE of Kota Belud, CL 2032, 5.viii.1985, leg. J.T. & D.A. Polhemus (JTPC, NHMW); 1 ♀ apt., Sabah, trib. to Moyog River nr. km 12 on Keningau Hwy., CL 2039, 6.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); 5 ♂ 3 ♀ apt., Sabah, Maliau Basin, fast flow stream, MB9a and MB10, 16.5.1996, leg. T.B. Lim (ZRCS, NHMW).

Redescription

Dimensions. — Apteroous form. Length 2.90 (♂), 3.45 (♀), width 2.00 (♂), 2.60 (♀), width of head 1.25 (♂), 1.30 (♀).

Colour (fig. 235). — Whole body prominently yellowish, with distinct dark marks. Eye brown to blackish. Interoculus yellowish, with one large heart-shaped dark mark at middle. Antennal segments dark, except basal 1/6 of segment 1, and the colour of segment 4 paler. Pronotum dark, only with two small yellowish marks at the lateroposterior margin. Mesonotum yellowish with broad dark lateral stripes which are confluent with the dark mark of metanotum. Metanotum with a triangular dark mark medially and two transverse blackish bands laterally. Mesopleura yellowish; upper and lower external angles of metacetabula brownish (fig. 190). Fore leg dark with basal 1/3 of femur yellowish. Middle and hind legs dark. Tergites 1-3 completely dark, 4 blackish with an obscure triangular yellowish mark in the middle, 5-7 yellowish but dark laterally, 8 yellowish with posterior margin dark. Laterotergites yellowish,

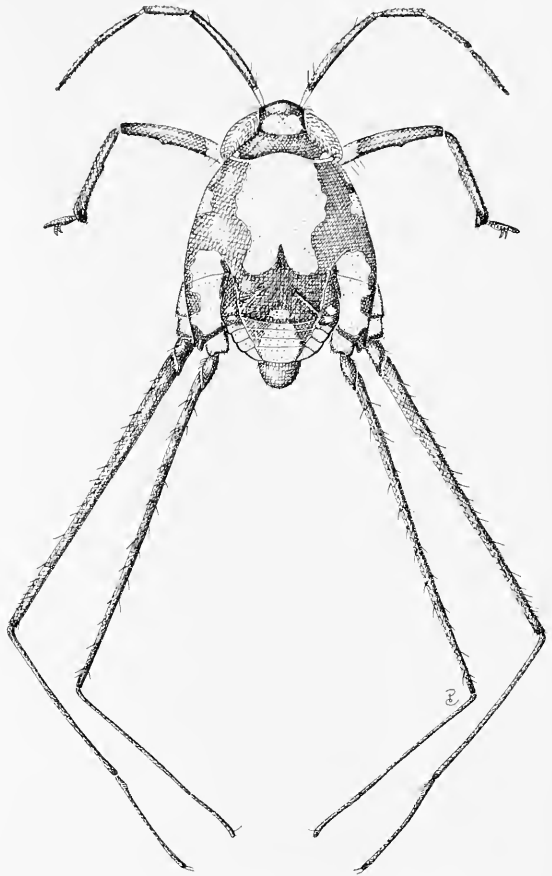


Fig. 235. *Ventidiidius (Ventidioides) kurtokalami*, paratype, apteroous male, length 2.90 mm.

3-4 more or less darkened. Connexiva 1-5 dark, 6-7 yellowish. Venter yellowish.

Pilosity. — Inner surface of antennal segment 1 with 2 subbasal and one subapical spines, through basal half of segment 1 to segment 3 with dark fine hair fringe; segments 2-4 with scattered brownish short setae (fig. 195). Dorsum and pleura clothed with dark pubescence on yellowish marks, and golden pubescence on dark part. Dark setae along both inner and external surfaces of fore tibia very prominent in male, which give the inner surface of fore tibia a wavy outline (fig. 200). Venter clothed by golden pubescence, especially on genital segments the pilosity longer and denser. Along mesosternal groove with a row of short dark bristles. Long stiff spines scattered along middle and hind legs.

Structural characters. — Interoculus subequal to width of an eye, 0.44 and 0.42 in male, 0.50 and 0.46

in female. Antennae not modified, measurements see table 1 (fig. 195). Thorax not bulbous, mesonotum somewhat swollen, its lateral width 1.10 (♂), 1.60 (♀). Intersegmental suture between meso- and metanotum obscure. Metanotum somewhat declivent. Lower part of metacetabula bilobate (figs. 207, 208). In the centre of male mesonotum with a small patch of minute black bristles which are not on a tubercle. Metasternal tubercle prominent in male. Fore femur slightly incrassate, with a blunt hump (fig. 200). Because of the prominent pilosity the fore tibia of male modified along inner and external margin, inner surface with a hump halfway its length, which is covered by erect pubescence, claw rising from 2/5 of segment 2 of fore tarsus. Anterior margin of abdominal tergite 1 obscure, anterior margins of tergites 2 and 3 obscure but eventually obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together in both sexes. Laterotergites broad.

Male terminalia. – Parameres (figs. 223, 224) asymmetrical, left paramere longer than right one, hooked, apical half curved upwards, with blunt apex. Endosoma (fig. 232): dorsal sclerite long and recurved proximally, ventral sclerite long, lateral sclerite straight, broadened and hooked at two ends, third lateral sclerite recurved backwards, apical accessory sclerite distinct.

Female terminalia. – Abdominal sternite 7 large, posterior margin smooth, concave forwards.

Macropterous form. – (fig. 214). Its maximum width 1.85 mm. Colour pattern: Pronotum black with two regular yellowish blotches separated by a thin brownish line. Wings anteriorly black with fine pubescence and with scattered longer black hairs. Posterior membranous part of wings dark brown. Other characters as in apterous form except the apex of pronotum pointed (measurements see table 3); length of fore wings from humeri to apex 2.15.

Distribution (map 5). – East Malaysia: Sabah.

Comparative notes. – This species is very similar to *V. nieseri* sp. n., both sharing the modified fore leg in males. For differences see comparative notes of *V. nieseri* sp. n.

21. *Ventidius (Ventidioides) nieseri* sp. n.
(figs. 191, 196, 201, 209, 210, 215, 217, 225, 226, 233, 236, map 5)

Type locality. – Brunei; Malaysia: Sarawak.

Type material. – Holotype ♂, apt., allotype ♀, apt., BRUNEI: Kuala Belalong Field Research Centre, 16.iv.1993, N.9345, leg. N. Nieser (RMNH). – Paratypes: 4♂ 2♀, all apt., same locality data as holotype (RMNH, NHMW, NCTN, PPCC); 3♂ 1♀ apt., 1♀ macr., DARS, Temburong, Belalong FR Centre, small

stream behind FRC, 16.-17.iv.1993, N9345A, leg. N. Nieser (NCTN); 3♂ 1♀ apt., 1♂ 1♀ macr., Temburong, Kuala Belalong Field Research Centre, Main river, N9344, 16.iv.1993, leg. N. Nieser, quiet edge downstream of boat & jetty (NCTN); 2♂ apt., Tembrong, Kuala Belalong Field Research Centre, sungai Baki, well sized tributary to main river, 17.iv.1993, leg. N. Nieser, N9364 (NCTN, NHMW); 1♀ apt., 9♂ 4♀ macr., Temburong, Belalong Field Res. Centre, Sungai Belalong, 60 m, 2-8.v.1995, leg. E. Heiss (ZCWA, PPCC, NCTN); 1♂ 1♀ apt., 1♂ 3♀ macr., Sg. Belalong, Kuala Belalong Field Studies Centre, 16.vi.1995, leg. S.L. Goh, GSL9504 (ZRCs, NHMW); 2♀ apt., 2♂ macr., same locality, 14.vi.1996, GSL9501 (ZRCs); MALAYSIA: 3♂ apt., Sarawak, Mulu N. P., right tributary to Tutoh river, Long Iman, 4.iii.1993, leg. H. Zettel (14) (NHMW). 10♂ 14♀, apt, Sarawak, Batang Ai N.P., Engkari River, E of Bandar Sri Amman, 19-20.ii.1993, leg. H. Zettel (7) (NHMW). 2♂, apt., Sarawak, Kapit Dist., Merirai V., 30-300 m, 1-6.viii.1958, leg. T. Maa (SEMC); 2♂ 2♀ apt., Sarawak, Kapit District, Merirai V., 30-300 m, 1-6.viii.1958, secondary forest, leg. T.C. Maa (BIMC); INDONESIA: 3♂ 2♀ apt., 3♂ 4♀ macr., C. Borneo (Kalimantan), Sg. Birang, leg. Mjöberg 1925, Coll. Dr. D. Mac Gillavry (ZMAC, NHMW, PPCC).

Etymology. – This species is named after our friend and colleague Dr. Nico Nieser for his devoted excellent work on aquatic and semiaquatic Heteroptera. Also for his generous offering of numerous interesting specimens from Sulawesi and Brunei, among them a large sample of this species.

Locality notes. – Small shaded river, bottom mainly pebbles, at margin and foot of waterfall.

Description

Dimensions. – Apterous form. Length 2.78 (♂), 2.68 (♀), width 1.81 (♂), 1.93 (♀), width of head 1.22 (♂), 1.25 (♀).

Colour (fig. 236). – Whole body prominently dark, with distinct yellowish marks. Eye blackish. Intraocular blackish, with one large M-shaped yellowish mark at posterior margin. Antennal segments dark, except basal 1/6 of segment 1. Pronotum dark, only with two small yellowish marks at the lateroposterior margin of pronotum. Mesonotum yellowish with lateral dark stripe which is confluent with the dark mark of metanotum, but not reaching its anterior margin. Metanotum with a triangular dark mark medially and two transverse blackish bands laterally. Mesopleura yellowish. External margin and lower part of metacetabula blackish (fig. 191). Fore leg dark with basal 1/5 of femur yellowish (fig. 201). Middle and hind legs dark. Tergites 1-3 completely dark, 4

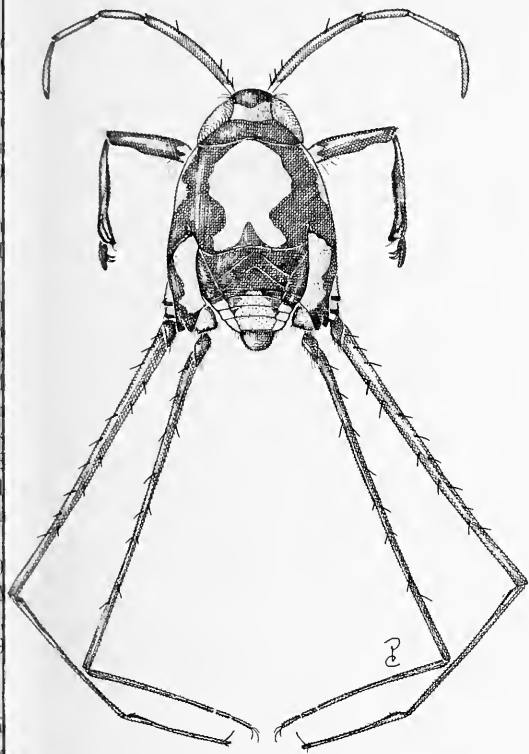


Fig. 236. *Ventidius (Ventidioides) nieseri*, holotype, apterous male, length 2.78 mm.

blackish with a triangular yellowish mark in the middle, 5 yellowish but dark laterally, 6-7 yellowish with posterior margin dark, 8 dark. Laterotergites 1-4 blackish, 5-7 yellowish. Connexiva 1-5 dark, 6-7 yellowish. Venter yellowish.

Pilosity. – Inner surface of antennal segment 1 with 4 subbasal and 1 subapical long spines, through basal half of segment 1 to segment 3 with dark fine hair fringe; segments 2-4 with scattered brownish short setae (fig. 196). Dorsum and pleura bearing golden pubescence on yellowish marks, metacetabula with dark pubescence. Dark setae along inner surface of fore tibia very prominent, which gives the inner surface of fore tibia a wavy outline (fig. 201). Venter clothed by golden pubescence, especially on genital segments the pilosity longer and denser. Along medium line of mesosternum with a dark stripe composed of short setae, setae pointed upwards and gradually tapering onto the anterior margin of mesosternum (fig. 215). Long stiff spines scattered along middle and hind legs.

Structural characters. – Interoculus subequal to width of an eye, 0.46 : 0.42 in male, 0.49 : 0.46 in female. Antennae not modified, but segment 1 distinct-

ly curved towards ventral side, measurements see table 1 (fig. 196). Thorax not bulbous, mesonotum somewhat swollen, its lateral width 1.43 (♂), 1.53 (♀). Intersegmental suture between meso- and metanotum obscure. Metanotum somewhat declivent. Lower part of metacetabula bilobate (figs. 209, 210). Metasternal tubercle hidden under mesosternum. Fore femur of male incrassate, halfway its inner surface with a blunt swelling (fig. 201), claw rising from 2/5 of segment 2 of fore tarsus. Anterior margin of abdominal tergite 1 obscure, anterior margins of tergites 2 and 3 obscure but eventually obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding sternites together in both sexes. Laterotergites broad.

Male terminalia. – Parameres (fig. 225, 226) asymmetrical, left paramere longer than right one, both hooked, apex of right paramere blunt, apex of left paramere sharper than right one; paramere extending beyond genital segments. Endosoma (fig. 233): dorsal sclerite long and recurved proximally, ventral sclerite long, lateral sclerites straight, broadened at distal ends, second lateral sclerites thin and weak, third lateral sclerite curved; apical accessory sclerite distinct.

Female terminalia. – Abdominal sternite 7 large, posterior margin smooth, concave forwards.

Macropterous form. – Its maximum width 1.90 mm. Colour pattern: Pronotum (fig. 217) black with two regular yellowish blotches. Wings anteriorly black with fine pubescence and with scattered longer black hairs. Posterior membranous part of wings dark brown. Other characters as in apterous form except the apex of pronotum pointed (measurements see table 3); length of fore wings from humeri to apex 2.65.

Distribution (map 5). – Brunei; East Malaysia: Sarawak; Indonesia: Kalimantan.

Comparative notes. – *Ventidius nieseri* sp. n. is closely related to *V. kurtokalami*. Differences are small and mainly found in males: The thickening in the middle of fore tibia is poorly developed in *V. nieseri* sp. n. and mainly indicated by a short erect pilosity; the fore femur is more curved basally in *V. nieseri* sp. n.; the setae along mesosternal groove are more conspicuous in *V. nieseri* sp. n.; both parameres are slightly more curved and distally somewhat more slender in *V. nieseri* sp. n.; and the endosoma of *V. nieseri* sp. n. has a larger apical accessory sclerite; the species are usually also separable in colour, which is brighter in both sexes in *V. kurtokalami*, but specific variability of both species is slightly overlapping.

22. *Ventidius (Ventidioides) beissi* sp. n.

(figs. 192, 197, 202, 211, 212, 218, 227, 228, 234, 237, map 5)

Type locality. – MALAYSIA: Sarawak.

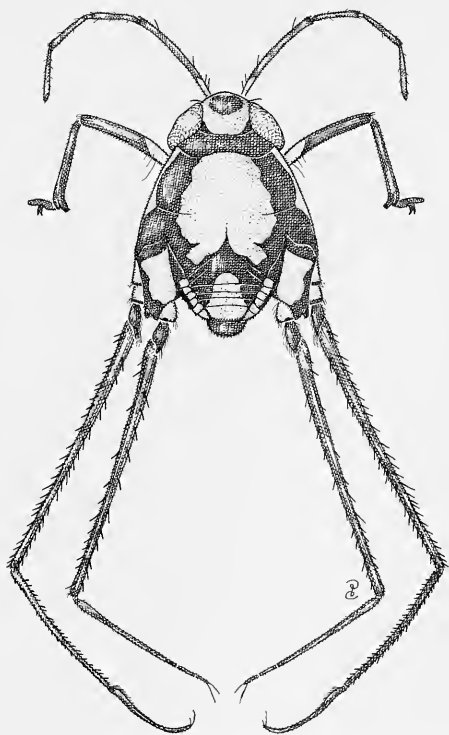


Fig. 237. *Ventidius (Ventidioides) heissi*, holotype, apterous male, length 2.73 mm.

Type material. – Holotype ♂, apt, MALAYSIA: Borneo / Sarawak, Kapit Dist., Merirai Village, 30-300 m, 1-6. VIII. 1958, secondary forest, No. M.B. 164, leg. T.C. Maa (BIMC). – Paratypes, 4 ♂, apt., same locality data as holotype (BIMC, NHMW, PPCC).

Etymology. – This species is named after our friend and colleague Prof. Mag. Dr. Ernst Heiss (Innsbruck), specialist in Oriental Aradidae, who provided us with interesting specimens from Brunei.

Description

Dimensions. – Apterous male. Length 2.73 (♂), width 1.85 (♂), width of head 1.12 (♂).

Colour (fig. 237). – Whole body prominently dark, with distinct yellowish marks. Eye blackish. Interoculus pale, with one large round dark mark. Antennal segments 1-3 dark except basal 2/5 of segment 1, segment 4 paler. Pronotum completely dark. Mesonotum with lateral dark mark. Metanotum with triangular dark mark. Mesopleura with a thick dark stripe (fig. 192; external angle of metacetabula dark (figs. 211, 212). Under strong light, the pubescence

reflects with a shining greenish metallic colour. Fore leg dark with basal 1/3 yellowish (fig. 202). Middle and hind legs dark. Tergites 1 completely dark, 2-5 yellowish but dark laterally, 6 mainly yellowish, 7 yellowish, posterior margin dark, 8 dark. Laterotergites 1 dark, 2-5 dark laterally, 6-7 yellowish. Connexiva 1-5 dark, 6-7 yellowish. Venter yellowish.

Pilosity. – Inner surface of antennal segment 1 with 3 subbasal, and 1 subapical long spines; through basal half of segment 1 to apical half of segment 4 with fine hair fringe; segments 2-4 with scattered dark short setae (fig. 197). Dorsum and pleura bearing dark pubescence on yellowish marks, and golden pubescence on dark parts. Venter clothed by golden pubescence, especially on genital segments, the pilosity very long and dense. Halfway the mesosternal groove with a blotch of dark setae which is displayed in two longitudinal lines, not as obvious as in other species of this group. Dark setae and long spines scattered along middle and hind legs.

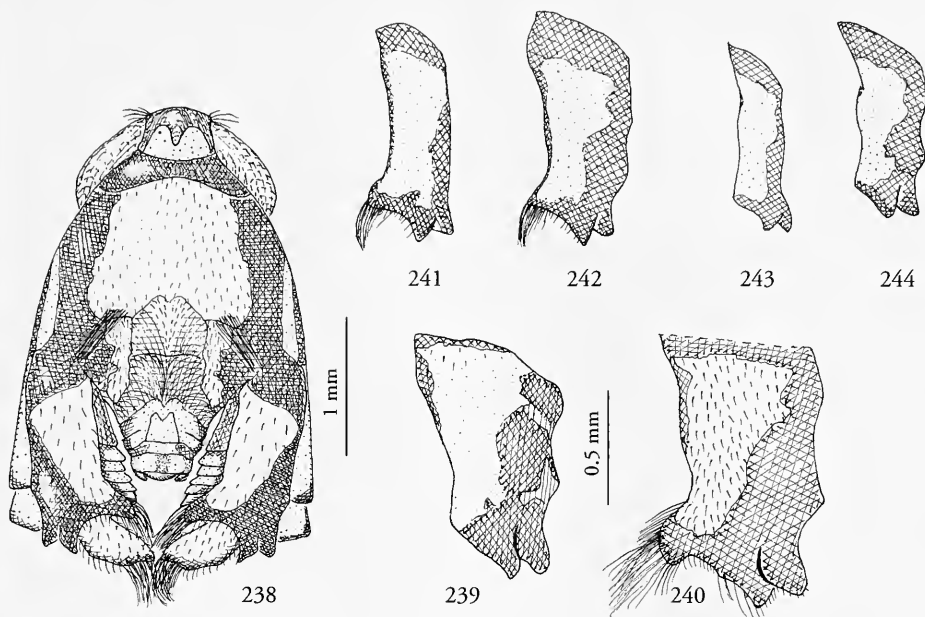
Structural characters. – Interoculus subequal to width of an eye, 0.42 : 0.39 in male. Antennae not modified, measurements see table 1 (fig. 197). Thorax not bulbous, mesonotum somewhat swollen, its lateral width 1.28 (♂). Intersegmental suture between meso- and metanotum obscure. Metanotum somewhat declivent. Lower part of metacetabula bilobate (figs. 211, 212). Metasternal tubercle not prominent in male. Fore femur slender, inner surface of fore tibia not modified, claw rising from 2/5 of segment 2 of fore tarsus. Anterior margin of abdominal tergite 1 indistinct; anterior margins of tergites 2 and 3 obliterated medially and protruding forward; abdominal sternite 7 as long as the preceding abdominal sternites together. Laterotergites broad.

Male terminalia. – Parameres (figs. 227, 228) asymmetrical, both hook-shaped, left paramere longer than right one, its apex more or less sharp; distal part of right paramere less pointed, with blunt apex; both parameres extending beyond genital segments. Endosoma (fig. 234): dorsal sclerite long and curved proximally; ventral sclerites long; first lateral sclerites straight, broadened at distal parts; second lateral sclerites thin and weak; third lateral sclerite oblique, thin and clear; apical accessory sclerite distinct.

Macropterous form and female. – Unknown.

Distribution (map 5). – East Malaysia: Sarawak.

Comparative notes. – This new species is similar to *V. xiphibion* and *V. xyele* in having a row of setae along mesosternal groove (although this is less prominent than in any other member of the *V. xiphibion*-group) and the lack of a thickening or tubercle on fore femur and fore tibia in male. The lack of a tuft of setae on fore trochanter, the long antennal segment 3, and the general shape of the parameres are characters which clearly distinguish *V. heissi* sp. n. from both



Figs 238-244. — 238, *Ventidius (Ventidiopsis) imadatei* Miyamoto, dorsal view of apterous female (appendages removed), length 2.90 mm. — 239, 241, 243, dorsal view of metacetabula; 240, 242, 244, dorsolateral view of metacetabula. — 239, *V. imadatei*, female; 240, male; 241, 242, *V. yangae*, male; 243, 244, female.

these Sulawesi species and show a closer relationship to the following two Bornean species, *V. kurtokalami* and *V. nieseri* sp. n. Males of *V. heissi* sp. n. are easy to distinguish from both of these species by the lack of special structures on fore femur and fore tibia (fig. 202), the less prominently developed setae along mesosternal groove, and the broad shape of the parameres: left paramere apically curved, right paramere apically blunt (figs. 227, 228).

***Ventidius (Ventidiopsis)* Miyamoto, 1967, stat. n.**

Ventidiopsis Miyamoto, 1967: 247. Type species by monotypy: *Ventidiopsis imadatei* Miyamoto, 1967. Andersen 1982: 393 (classification).

Diagnosis. — Relatively dark-coloured, pronotum black; metacetabula bilobate; sexes very different: females strongly modified: thorax dorso-ventrally swollen, metacetabula with a mediad, hairy process; metacoxa with mediad process; abdomen shortened, most tergites fused, sternite 7 strongly modified, with two elongate lateral projections and two caudally pointed medial lobes. Males similar to the subgenus *Ventidioides*, but antennae much stouter, especially the long segment 1.

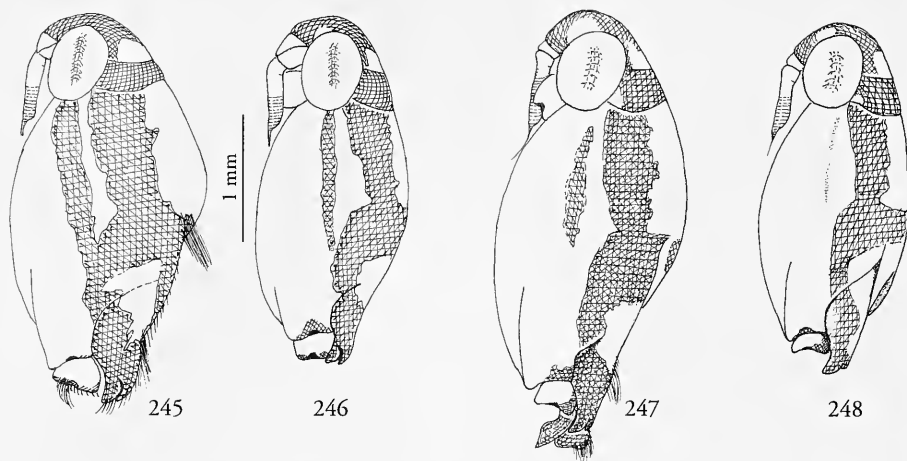
Distribution (map 6). — Endemic to Borneo.

Key to apterous specimens of the subgenus *Ventidiopsis*

1. Female with tuft of black bristles on posterior margin of mesonotum, with acutely pointed medial process of metacetabula (fig. 240), with longer process of metacoxa (fig. 238), and with long lateral projections of sternite 7 (fig. 263); male with longer left paramere (fig. 258) and broader distal part of right paramere (fig. 257) (Borneo: Brunei, Sarawak) *V. imadatei*
- Female without tuft of black bristles on posterior margin of mesonotum, with rectangular medial process of metacetabula (figs. 241, 242), with shorter process of metacoxa (fig. 265), and with short, appressed lateral projections of sternite 7 (fig. 264); male with shorter left paramere (fig. 260) and more slender distal part of right paramere (fig. 259) (Borneo: Sabah) *V. yangae* sp. n.

The *Ventidius imadatei*-group

Notes. — Only two, very closely related species are known, which are so far the only representatives of the subgenus. For diagnostic characters see diagnosis of the subgenus. Macropterous morphs are unknown.



Figs. 245-248. Lateral view of body, showing the colour pattern of pleura. – 245, *Ventidiopus imadatei*, male; 246, female; 247, *V. yangae*, male; 248, female.

23. *Ventidiopus (Ventidiopsis) imadatei* Miyamoto comb. n.

(figs. 238-240, 245, 246, 249, 250, 253, 254, 257, 258, 261, 263, map 6)

Ventidiopsis imadatei Miyamoto, 1967: 247-250 (gen. n., sp. n., descr., illustr.)

Type locality. – BRUNEI.

Material examined. – 3♂ 1♀ apt., BRUNEI: Temburong, Kuala Belalong Field Res. Centre, main river, N9344, 16.iv.1993, leg. N. Nieser, quiet edge downstream of boat & jetty (NCTN, PPCC); 2♂ apt., Temburong, Kuala Belalong Field Research Centre, Sungai Baki, well sized tributary to main river, 17.iv.1993, leg. N. Nieser, N9364 (RMNH, NCTN). 5♂ apt., Temburong, Belalong Field Res. Centre, Sungai Belalong, 60 m, 2-8.v.1995, leg. E. Heiss (HCIA, ZCWA, PPCC); 4♂ apt., Sg. Belalong, Kuala Belalong Field Studies Centre, 16.vi.1995, leg. S.L. Goh, GSL9504 (ZRCS); 3♂ 4♀ apt., same locality, 14.vi.1995, leg. S.L. Goh, GSL9501 (ZRCS, NHMW); 1♂ 1♀ apt., Sarawak, Kapit District, Merirai V., 30-300 m, 1-6.viii.1958, secondary forest, leg. T.C. Maa (BIMC), 9♂, 6♀, apt., Sarawak, Mulu NP, 3-5.3.1993, leg. H. Zettel (14), (NHMW, PPCC); 1♀, apt., Sarawak, Lambir Hills NP, 25 km S Miri, 24-25.2.1993, leg. H. Zettel (9), (NHMW); MALAYSIA: 1♂ apt., Sabah, North Borneo (SE), Forest Camp, 19 km N of Kalabakan, 12.xi.1962, leg. Hirashima (BIMC); 1♀ apt., Sabah, Maliau Basin, fast flow stream, MB9a, 16.5.1996, leg. T.B. Lim (UMSM); 2♂, 1♀ apt., Sabah, Tibow Estate, slow flow stream, MB42, 25.5.1996, leg. T.B. Lim (ZRCS, UMSM).

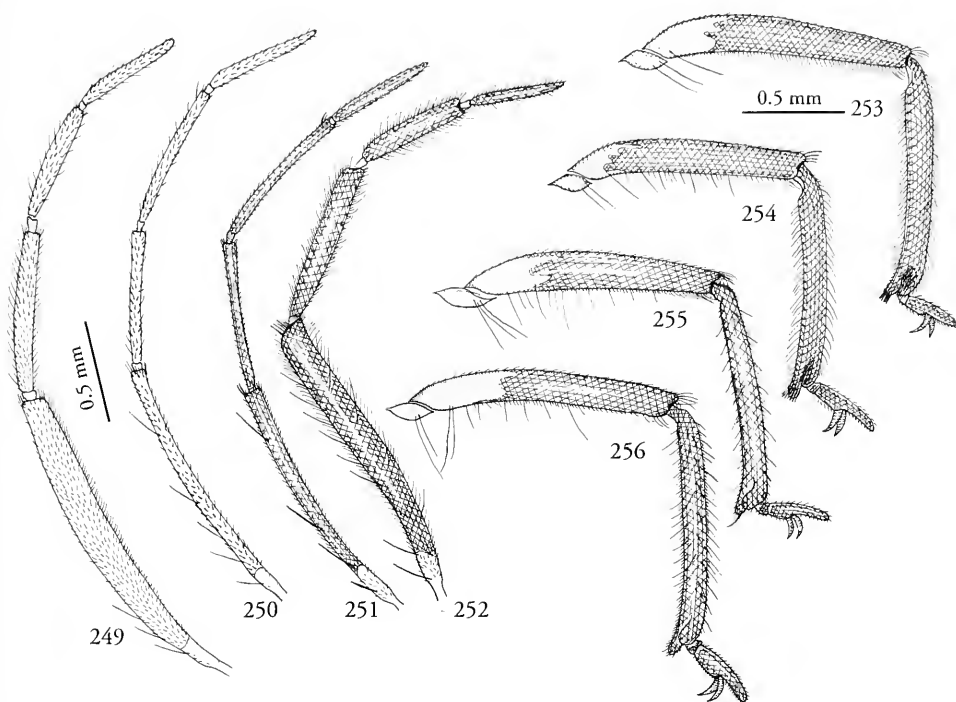
Material not examined (checked by John T. Polhemus, pers. communication). – MALAYSIA: 1♀ apt., Sarawak, Samaritan River, 2 km W of Tubeh, CL 2047, 19.viii.1985, leg. J.T. & D.A. Polhemus (JTPC); 2♂ 4♀ apt., Sabah, tributary to Moyog River, near km 12 on Keningau Highway, CL 2039, 6.viii.1985, leg. J.T. & D.A. Polhemus (JTPC).

Description

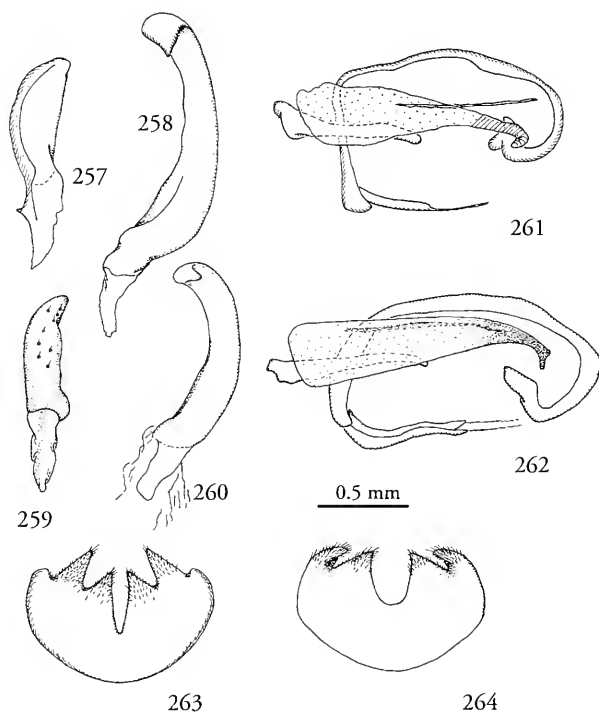
Dimensions. – Apterous form. Length 2.73 (♂), 2.90 (♀), width 1.83 (♂), 1.80 (♀), width of head 1.15 (♂), 1.23 (♀).

Colour (fig. 238). – Whole body prominently dark, with distinct yellowish marks. Eye blackish. Interoculus blackish, with one large M-shaped yellowish mark at posterior margin. Antennal segments dark, except base of segment 1. Pronotum dark, only with two small yellowish marks at the lateroposterior margin of pronotum. Mesonotum in male yellowish with lateral dark stripe which is confluent with the dark mark of metanotum and reaching its anterior margin. Mesonotum in female broadly yellowish with lateral dark stripe which is confluent with the dark mark of metacetaula. Metanotum of male with a triangular dark mark medially and two transverse blackish bands laterally. Metanotum in female blackish at anterolateral corner, inner side of lateral longitudinal elevations. Mesopleura yellowish with a dark stripe running through its length (figs. 245, 246); upper and lower external angles of metacetaula blackish (figs. 239, 240). Fore leg dark with basal 1/4-1/3 of fore femur yellowish (figs. 253, 254). Middle and hind leg dark. In males, tergites 1-3 completely dark, tergite 4 blackish with a triangular yellowish mark in the middle, tergite 5 yellowish but dark laterally, 6-7 yellowish with posterior margin dark, tergite 8 dark. Laterotergites 1-5 blackish, lateral plates 6-7 yellowish. Connexiva 1-5 dark, 6-7 yellowish. In females, tergites 1-3 black with broad yellowish lateral marks, tergites 4-8 yellowish with blackish lateral margins. Venter yellowish in both sexes.

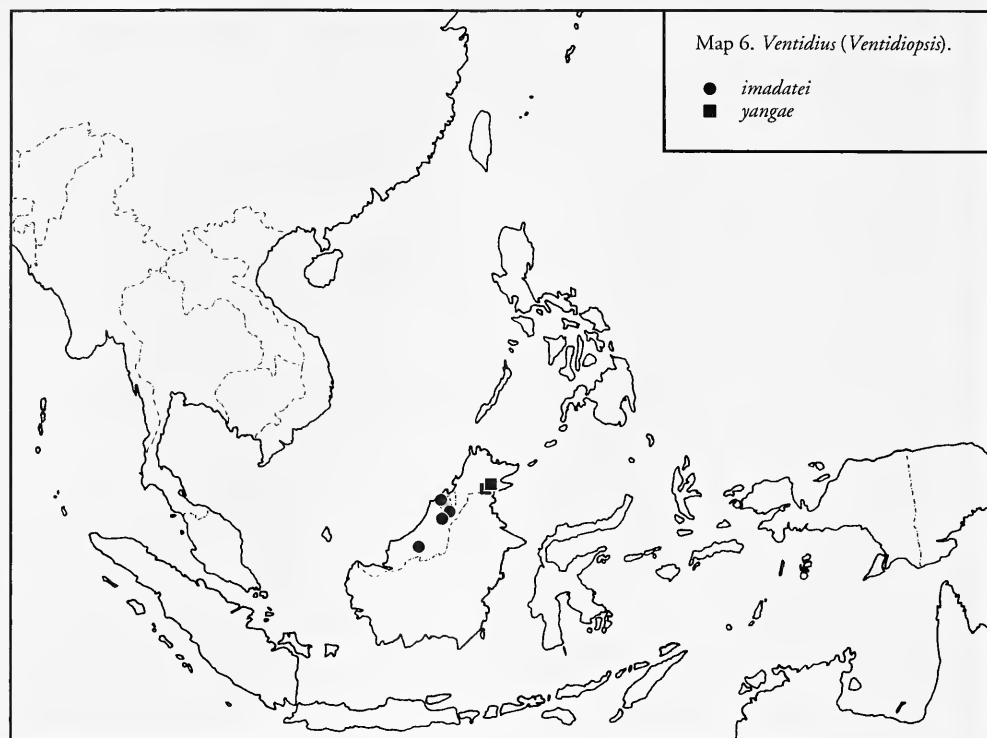
Pilosity. – Inner surface of male first antennal seg-



Figs. 249-252.
Dorsal view of male right antennae; 253-256. Dorsal view of right fore leg. — 249, 253, *Ventidius imadatei*, female; 250, 254, male; 252, 255, *V. yangae*, female; 251, 256, male.



Figs. 257-264.
257-260, external view of right (257, 259) and left (258, 260) parameres; 261, 262, lateral view of endosoma sclerites; 263, 264. VIIth sternite of female. — 257, 258, 261, 263, *Ventidius imadatei*; 259, 260, 262, 264, *V. yangae*.



ment with 2-3 subbasal spines, but without a subapical spine as usual case in other *Ventidius* species (fig. 249). In females, along inner surface of first antennal segment with 5-6 long spines (fig. 250); in males, through basal half of segment 1 to segment 3 with dark fine hair fringe and segments 2-4 with scattered brownish short setae. Dorsum and pleura bearing dark pubescence on yellowish marks, and greyish pubescence on dark parts. Inner surface of fore tibia with suberect pilosity (figs. 253, 254). Females with two pairs of tufts consisting of long stiff black setae on posterior margin of mesonotum and on inner projection of metacetabula. Metacoxa of female on inner projection with numerous long black hairs. Venter clothed by dark pubescence. Long stiff spines scattered along middle and hind legs.

Structural characters. – Interoculus slightly broader than width of an eye, 0.46 : 0.41 in male, 0.43 : 0.41 in female. Male antenna thick (fig. 249), segment 1 distinctly curved towards ventral side in male, measurements see table 1. Thorax bulbous in female, mesonotum strongly swollen, which makes the female appear thick from lateral view, its lateral width 1.07 (♂), 1.40 (♀). Intersegmental suture between meso- and metanotum obscure. Metanotum declivent. Metacetabula bilobate in lower part, in female with a

sharp, internally directed processus (fig. 240). Fore femur slender in both sexes, claws rising from $\frac{1}{3}$ of segment 2 of fore tarsus. In males anterior margin of abdominal tergite 1 visible, anterior margins of tergites 2 and 3 obliterated medially and protruding forward. In females abdomen shortened, sutures between tergites 1-7 obscure or only laterally visible; Abdominal sternite 7 in male shorter than the preceding abdominal sternites together, in female longer and modified. Laterotergites broad in male, narrow in female.

Male terminalia. – Parameres (fig. 257, 258) asymmetrical, left paramere twice as long as right one, extending beyond genital segments, its apical part curved upwards, with blunt, laterad curved apex; right paramere short, with pointed apex. Endosoma (fig. 261): dorsal sclerite long and recurved proximally, and broadened and homogeneous in dorsodistal half, ventral sclerites short, lateral sclerites straight, broadened at basal end, second lateral sclerites thin and weak. Third lateral sclerite curved distally and broadened at proximal half.

One male from Tibow Estate with an elongate, sharply ending right paramere seems to be an individual aberration because a second male from the same locality has a normally shaped paramere.

Female terminalia. – Apex of abdomen in dorsal

view with distinct, mediad curved lateral projections of sternite 7; genital segments in dorsal view concealed under preceding abdominal segments. In ventral view abdominal sternite 7 large, hiding the gonocoxae completely, with two slender, strongly developed lateral projections and two large triangular, sharply pointed medial lobes (fig. 263).

Macropterous form. – Unknown.

Distribution (map 6). – Brunei; East Malaysia: Sarawak, Sabah.

Comparative notes. – Closely related to the following species, for differences see key and comparative notes of *V. yangae* sp. n.

24. *Ventidius (Ventidiopsis) yangae* sp. n.

(figs. 241–244, 247, 248, 251, 252, 255, 256, 259, 260, 262, 264–266, map 6)

Type locality. – MALAYSIA: Sabah.

Type material. – Holotype ♀, apt. and allotype ♂, apt., Sabah, Danum Valley, Palum Tambun, 7–12.2.1997, leg. Zettel et al. (P90) (UMSM). – Paratypes: 1 ♂, 1 ♀ apt., same locality data (NHMW); 3 ♂ apt., Sabah, Danum Valley, Segama River, 'Beach', 4.2.1997, leg. H. Zettel (10) (UMSM, NHMW); 6 ♂ 5 ♀ apt., Sabah, Danum Valley, Palum Tambun, 7–12.2.1997, leg. Zettel et al. (different project numbers) (UMSM, SPCM, NHMW); 1 ♀ apt., Sabah, Danum Valley, Segama River above Field Centre, 2.2.1997, leg. H. Zettel (1) (NHMW); 2 ♂ 3 ♀ apt., Sabah, Danum Valley, Sapat Kalisan, 12.2.1997, leg. H. Zettel (15) (NHMW).

Etymology. – Dedicated to Dr. Yang Chang Man (ZRCs) for her continuous help in making type specimens and other specimens available for this study and for her various contributions to the knowledge of Malaysian water bugs.

Description

Dimensions. – Apterous form. Length 2.82 (♂), 3.00 (♀), width 1.65 (♂), 1.82 (♀), width of head 1.20 (♂), 1.20 (♀).

Colour (figs. 265, 266). – Whole body dark, with distinct yellowish marks. Eye blackish. Interoculus blackish, with one large M-shaped yellowish mark at posterior margin. Antennal segments dark, except base of segment 1. Pronotum dark, only with two small yellowish marks at the lateroposterior margin of pronotum. Mesonotum in male yellowish with lateral dark stripe which is confluent with the dark mark of metanotum and reaching its anterior margin. Mesonotum in female broadly yellowish with lateral dark stripe which is confluent with the dark mark of metacetabula. Metanotum of male with a triangular

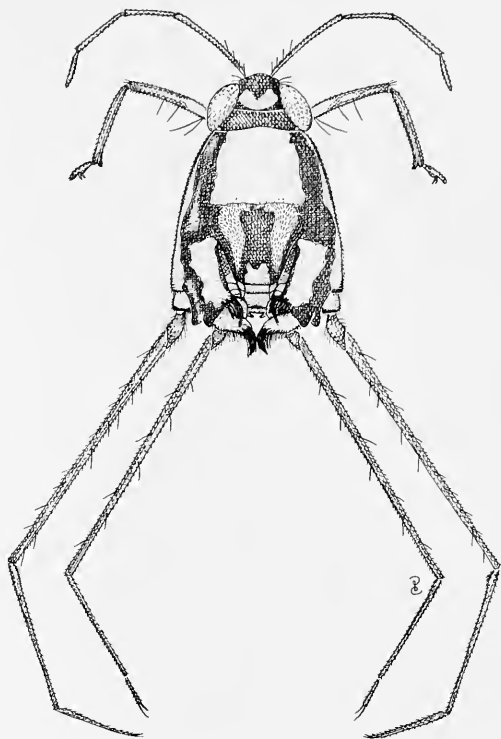


Fig. 265. *Ventidius (Ventidioides) yangae*, holotype, apterous female, length 2.90 mm.

dark mark medially and two transverse blackish bands laterally. Metanotum in female blackish at anterolateral corner, inner side of lateral longitudinal elevations with an elongate dark mark medially, which is confluent laterally with abdominal dark marks. Female mesopleura yellowish with a dark stripe running through its length (fig. 247), male mesopleura totally yellowish or with thin brownish longitudinal stripe (fig. 248); upper and lower external angles of metacetabula blackish (figs. 241–244). Fore leg dark with basal 1/3 of fore femur yellowish (figs. 255, 256). Middle and hind leg dark. In males, tergites 1–3 completely dark, tergite 4 blackish with a triangular yellowish mark in the middle, tergite 5 yellowish but dark laterally, 6–7 yellowish with posterior margin dark, tergite 8 dark. Laterotergites 1–5 blackish, lateral plates 6–7 yellowish. Connexiva 1–5 dark, 6–7 yellowish. In females, tergites 1 yellowish with lateral dark marks, 2–7 yellowish, tergite 8 yellowish with dark patches anteriorly. Venter yellowish in both sexes.

Pilosity. – Inner surface of male antennal segment 1 with 2–3 subbasal spines, but without a subapical spine as usual case in other *Ventidius* species (fig.

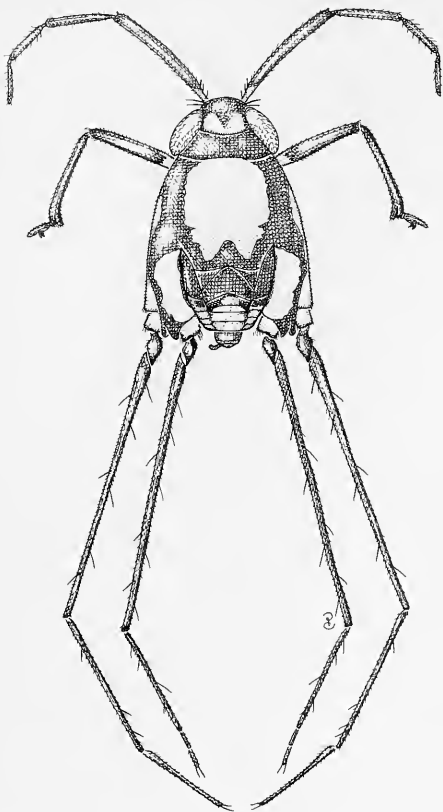


Fig. 266. *Ventidius (Ventidioides) yangae*, allotype, apterous male, length 2.73 mm.

252). In females, along inner surface of antennal segment 1 with 4-5 long spines (fig. 251); in males, through basal half of segment 1 to segment 3 with dark fine hair fringe and segments 2-4 with scattered brownish short setae. Dorsum and pleura bearing dark pubescence. Inner surface of fore tibia with suberect pilosity (figs. 255, 256). Females with one pair of tufts consisting of long stiff black setae on inner projection of metacutabula (fig. 242). Metacoxa of female on inner projection with numerous long black hairs. Venter clothed by dark pubescence. Long stiff spines scattered along middle and hind legs.

Structural characters. – Interoculus slightly broader than width of an eye, 0.42 : 0.40 in male, 0.50 : 0.46 in female. Male antenna thick (fig. 252), segment 1 distinctly curved towards ventral side in male, measurements see table 1. Thorax bulbous in female, mesonotum strongly swollen, which makes the female appear thick from lateral view, its lateral width 1.05 (♂), 1.35 (♀). Intersegmental suture between meso- and metanotum obscure. Metanotum declivent, espe-

cially in females. Metacutabula bilobate in lower part, in female with a rectangular internally directed process (figs. 241-244). Fore femur slender in both sexes, claws rising from $\frac{1}{3}$ of segment 2 of fore tarsus. In males anterior margin of abdominal tergite 1 visible, anterior margins of tergites 2 and 3 obliterated medially and protruding forward. In females abdomen shortened, sutures between tergites 1-7 obscure or only laterally visible; Abdominal sternite 7 in male shorter than the preceding abdominal sternites together, in female longer and modified. Laterotergites broad in male, narrow in female.

Male terminalia. – Parameres (fig. 259, 260) asymmetrical, left paramere one and a half times as long as right one, extending beyond genital segments, its apical part curved upwards, with blunt, laterad curved apex; right paramere short, with pointed apex. Endosoma (fig. 262): dorsal sclerite long and recurved proximally, ventral sclerites short, lateral sclerites straight, broadened proximally, second lateral sclerites thin and weak, which are covered by the third lateral sclerite, the third lateral sclerite hooked distally and broadened at proximal half.

Female terminalia. – Apex of abdomen in dorsal view without distinct projections of sternite 7; genital segments in dorsal view concealed under preceding abdominal segments. In ventral view abdominal sternite 7 (fig. 264) large, hiding the gonocoxae anteriorly, with two short angular lateral projections which are appressed to tergite 7, and with two large triangular, pointed medial lobes, distance between the two lobes relatively broader comparing with *V. (Ventidiopsis) imadatai*.

Macropterous form. – Unknown.

Distribution (map 6). – East Malaysia: Sabah.

Comparative notes. – Closely related to *V. imadatai*. Main differences are presented in the key. In addition, the medial lobes of the female sternite 7 are of different shapes (see figs. 259-264). Differences in the endosoma are found in the distally hooked third lateral sclerite of *V. yangae* sp. n., which is less curved in *V. imadatai*.

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Table 1. Lengths of antennal segments in *Ventidius* species (in mm).

		I	II	III	VI
<i>V. aquarius</i>	♂	1.78	1.21	0.65	0.58
	♀	1.57	0.80	0.66	0.57
<i>V. harrisoni</i>	♂	1.50	0.94	0.75	0.57
	♀	1.27	0.61	0.64	0.52
<i>V. longitarsus</i>	♂	2.00	1.32	0.70	0.88
	♀	1.80	0.79	0.65	0.79
<i>V. malayensis</i>	♂	1.95	1.37	0.65	0.78
	♀	1.45	0.79	0.58	0.73
<i>V. usingeri</i>	♂	1.65	1.32	0.79	0.61
	♀	1.43	0.82	0.72	0.58
<i>V. hungerfordi</i>	♂	1.10	0.67	0.49	0.44
	♀	1.00	0.42	0.54	0.42
<i>V. polhemorum</i>	♂	1.07	0.58	0.49	0.40
	♀	0.90	0.43	0.51	0.40
<i>V. wernerii</i>	♂	1.05	0.50	0.40	0.41
	♀	0.90	0.40	0.47	0.37
<i>V. pilosus</i>	♂	1.15	0.53	0.32	0.39
	♀	1.01	0.43	0.41	0.41
<i>V. henryi</i>	♂	0.93	0.41	0.42	0.35
	♀	0.88	0.34	0.45	0.35
<i>V. chinai</i>	♂	1.15	0.56	0.41	0.36
	♀	1.05	0.44	0.49	0.42
<i>V. modulatus</i>	♂	1.20	0.61	0.48	0.39
<i>V. kuiterti</i>	♂	1.21	0.39	0.42	0.45
	♀	1.12	0.32	0.48	0.50
<i>V. karen</i>	♂	1.40	0.32	0.35	0.48
	♀	1.14	0.31	0.43	0.47
<i>V. sp.</i>	♀	1.12	0.36	0.50	0.52
<i>V. pulai</i>	♂	1.17	0.42	0.48	0.49
	♀	1.13	0.40	0.58	0.53
<i>V. lundbladi</i>	♂	1.18	0.37	0.41	0.40
	♀	0.96	0.36	0.51	0.44
<i>V. xiphibion</i>	♂	1.29	0.47	0.38	0.50
	♀	1.25	0.48	0.50	0.51
<i>V. xyle</i>	♂	1.26	0.50	0.41	0.52
	♀	1.30	0.54	0.54	0.51
<i>V. kurtokalami</i>	♂	1.22	0.57	0.55	0.56
	♀	1.30	0.50	0.70	0.60
<i>V. nieseri</i>	♂	1.30	0.51	0.53	0.50
	♀	1.29	0.50	0.70	0.60
<i>V. heissi</i>	♂	1.15	0.47	0.51	0.53
<i>V. imadatei</i>	♂	1.50	0.77	0.57	0.51
	♀	1.20	0.55	0.60	0.48
<i>V. yangae</i>	♂	1.50	0.70	0.52	0.45
		1.00	0.96	0.08	0.28
<i>Esakia ventidioides</i>	♂	1.05	0.35	0.33	0.28
	♀	1.10	0.30	0.33	0.30

Table 2. Lengths of leg segments in *Ventidius* species.

species	male (♂)			female (♀)		
	femur	tibia	tarsi	femur	tibia	tarsi
<i>V. aquarius</i>						
fore leg	1.43	1.30	0.39	1.38	1.26	0.41
mid leg	3.95	2.48	1.45	3.75	2.25	1.40
hind leg	4.18	2.03	0.56	4.00	2.15	0.59
<i>V. usingeri</i>						
fore leg	1.60	1.35	0.46	1.46	1.18	0.42
mid leg	4.15	2.51	1.60	3.77	2.40	1.48
hind leg	4.45	1.90	0.62	3.76	2.01	0.68
<i>V. harrisoni</i>						
fore leg	1.42	1.15	0.39	1.18	1.05	0.42
mid leg	3.47	2.04	1.20	3.00	1.70	1.07
hind leg	3.50	1.76	0.53	3.03	1.54	0.56
<i>V. malayensis</i>						
fore leg	1.77	1.45	0.60	1.50	1.30	0.60
mid leg	4.50	2.75	1.65	4.07	2.46	1.58
hind leg	4.82	2.50	0.70	4.17	2.36	0.75
<i>V. longitarsus</i> sp. n. (Da Lat)						
fore leg	1.80	1.60	0.77	1.66	1.36	0.64
mid leg	4.90	3.00	1.90	4.45	2.70	1.60
hind leg	4.90	2.65	0.70	4.30	2.56	0.80
<i>V. longitarsus</i> sp. n. (Gia Lai-Kontum)						
fore leg	1.53	1.55	0.77	1.51	1.40	0.62
mid leg	4.53	2.88	1.70	4.16	2.60	1.70
hind leg	4.71	2.57	0.92	4.00	4.00	0.88
<i>V. hungerfordi</i>						
fore leg	1.11	0.93	0.33	1.10	0.92	0.32
Mid leg	2.75	1.50	1.00	3.00	1.50	1.10
hind leg	3.10	0.70	0.35	3.00	1.30	0.36
<i>V. polhemorum</i> sp. n.						
fore leg	1.05	0.90	0.30	1.05	0.90	0.30
mid leg	2.67	1.28	1.00	2.77	1.43	1.06
hind leg	2.57	1.12	0.40	2.68	1.25	0.45
<i>V. werneri</i>						
fore leg	1.03	0.86	0.30	0.95	0.93	0.28
mid leg	2.66	1.42	0.95	2.68	1.41	0.98
hind leg	2.68	1.11	0.38	2.61	1.11	0.35
<i>V. pilosus</i> sp. n.						
fore leg	1.08	0.96	0.35	1.13	1.05	0.38
mid leg	3.06	1.78	1.30	3.33	1.90	1.35
hind leg	3.46	1.78	0.58	3.66	1.65	0.65
<i>V. henryi</i>						
fore leg	1.06	0.95	0.31	1.05	0.84	0.31
mid leg	3.03	1.76	1.07	3.03	1.80	1.07
hind leg	3.38	1.30	0.41	3.40	1.23	0.41
<i>V. modularis</i>						
fore leg	1.10	0.96	0.35	1.11	0.96	0.34
mid leg	3.00	1.75	1.11	3.26	1.80	1.17
hind leg	3.19	1.37	0.42	3.40	1.50	0.50
<i>V. kuiterti</i>						
fore leg	1.06	0.91	0.32	1.10	1.00	0.32
mid leg	3.00	1.16	1.09	3.20	1.75	1.00
hind leg	3.25	1.05	0.45	3.50	0.85	??
<i>V. karen</i>						
fore leg	1.12	0.90	0.30	1.20	0.99	0.38
mid leg	3.00	1.50	1.00	3.25	1.66	1.12
hind leg	3.18	1.17	0.40	3.55	1.42	0.50
<i>V. sp. (V. karen? from Viet Nam)</i>						
fore leg	??	??	??	1.30	1.04	0.38
mid leg	??	??	??	3.48	1.90	1.22
hind leg	??	??	??	3.58	1.58	0.54

continued on page 208

<i>V. pulai</i>						
fore leg	1.11	0.90	0.33	1.11	0.94	0.33
mid leg	3.01	1.61	1.02	3.20	1.75	1.05
hind leg	3.21	1.28	0.45	3.51	1.38	0.51
<i>V. lundbladi</i>						
fore leg	1.10	0.86	0.28	1.08	0.90	0.31
mid leg	2.54	1.51	1.05	3.00	1.60	0.94
hind leg	2.76	1.20	0.52	2.97	1.28	0.43
<i>V. xiphibion</i>						
fore leg	1.10	0.90	0.35	1.20	0.90	0.30
mid leg	3.20	1.90	1.10	3.30	1.90	1.10
hind leg	3.50	1.50	0.40	3.70	1.60	0.40
<i>V. xyele</i>						
fore leg	1.20	1.10	0.40	1.20	1.00	0.40
mid leg	3.40	1.90	1.10	3.50	1.90	1.10
hind leg	3.90	1.70	0.50	3.90	1.80	0.50
<i>V. kurtokalami</i>						
fore leg	1.20	1.05	0.40	1.40	1.20	0.40
mid leg	3.30	1.90	1.20	3.70	2.15	1.35
hind leg	3.60	1.65	0.56	3.70	1.88	0.52
<i>V. nieseri</i> sp. n.						
fore leg	1.25	1.05	0.36	1.35	1.14	0.40
mid leg	3.40	1.89	1.18	3.59	2.02	1.26
hind leg	3.61	1.50	0.50	3.86	1.77	1.57
<i>V. heisi</i> sp. n.						
fore leg	1.11	0.98	0.37			
mid leg	3.20	1.73	0.95			
hind leg	3.19	1.37	0.48			
<i>V. imadatei</i>						
fore leg	1.30	1.00	0.34	1.18	1.10	0.36
mid leg	3.50	1.94	1.18	3.48	1.90	1.28
hind leg	3.69	1.40	0.43	3.57	1.36	0.48
<i>V. yangae</i> sp. n.						
fore leg	1.15	1.02	0.39	1.00	0.96	0.36
mid leg	3.20	1.75	1.12	2.85	1.58	1.25
hind leg	3.28	1.30	0.48	3.30	1.44	0.44
<i>Esakia ventidioides</i>						
fore leg	1.10	0.93	0.27	1.15	1.00	0.30
mid leg	3.20	2.44	0.92	3.60	2.50	0.95
hind leg	3.70	0.95	0.30	3.90	1.05	0.38

Table 3. Measurements of pronotum of macropterous form of *Ventidius* species. For an explanation of the characters between parentheses, see fig. 2.

Species	Median length (j)	humeral width (k)	lateral length (l)	lateral length (m)
<i>V. aquarius</i>	2.70	2.00	0.80	1.90
<i>V. usingeri</i>	1.95	2.00	0.98	1.58
<i>V. malayensis</i>	2.10	2.25	0.10	1.60
<i>V. henryi</i>	1.32	1.42	0.60	1.18
<i>V. hungerfordi</i>	1.40	1.51	0.64	1.51
<i>V. polhemorum</i>	1.40	1.54	0.70	1.10
<i>V. wernerii</i>	1.60	1.70	0.50	1.30
<i>V. pilosus</i>	1.65	1.80	0.77	1.38
<i>V. modulatus</i>	1.61	1.65	0.71	1.40
<i>V. karen</i>	1.48	1.90	0.30	0.84
<i>V. pulai</i>	1.45	1.66	0.40	1.25
<i>V. xyele</i>	2.55	1.70	0.75	1.35
<i>V. xiphibion</i>	2.70	1.75	0.88	1.45
<i>V. kurtokalami</i>	1.67	1.73	0.79	1.38
<i>V. nieseri</i>	1.75	1.90	0.80	1.40

ACINORETRACUS, A NEW AFROTROPICAL GENUS
FOR SOME SPECIES PREVIOUSLY PLACED IN
DICROTENDIPES (DIPTERA: CHIRONOMIDAE:
CHIRONOMINAE)

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A new genus, *Acinoretracus*, is established for four Afrotropical species previously placed in *Dicrotendipes*. These species are *Chironomus* (*Carteria*) *regalis* Goetghebuer, 1936 (selected as type-species for *Acinoretracus*); *Ch. (Dicrotendipes) multispinosus* Freeman, 1957; *Ch. (D.) penicillatus* Freeman, 1957; and *Ch. (D.) crispus* Freeman, 1957. The adult male and female, pupa and larva are described and figured for *A. multispinosus* and *A. penicillatus*, and notes are given for the other two species. *Acinoretracus* is very close to *Kiefferulus* but can be distinguished by the following characters: adult male: superior volsella with dense apical brush of long, fine setae, without large setae; inferior volsella with narrowed, upturned apex bearing several apical setae; adult female: gonocoxite IX vestigial, without setae; pupa: cephalic tubercles low, rounded; thoracic horn base with anteriorly directed flange-like lobe; long, taeniate ventral antepronotal and anterior precorneal setae; pedes spurii B and larval ventral tubules absent; larva: S I plumose on inner side only; mentum with first and second lateral teeth not fused; short and wide, medially contiguous ventromental plates, with basally forked striae; mandible with rugose lateral margin and U shaped pecten mandibularis; lateral and ventral tubules absent.

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Key words. – Diptera; Chironomidae; taxonomy; *Acinoretracus*; *Kiefferulus*; *Dicrotendipes*; Afrotropical.

Compared to the western Palaearctic and most of the Nearctic, the taxonomy of the midge family Chironomidae from the Afrotropical region is poorly known. Generic relationships of many species are uncertain because their immature stages, often necessary for delimiting genera, are unknown, in spite of their ecological importance in African fresh waters. Here we report on reared material of several problematic species that require establishment of a new genus.

Goetghebuer (1936) placed a newly described Afrotropical species, *Chironomus regalis*, in the subgenus *Carteria* Kieffer, 1921. *Carteria* had been shown earlier (Strand 1928) to be preoccupied by *Carteria* Dising, 1866; Strand (1928) offered *Carteronica* as a replacement name; *Tendipes longilobus* (Kieffer, 1916) was retained as the type-species. Freeman (1957) considered *Carteronica* to be a synonym of *Chironomus*

(*Dicrotendipes*). Later workers, such as Hamilton et al. (1969), re-elevated *Dicrotendipes* Kieffer, 1913, to generic status. Epler (1987:19, 1988:9, 32) noted that four Afrotropical species placed in *Dicrotendipes* by Freeman & Cranston (1980) could not be maintained in that genus. Epler (1988) also stated that *Carteronica* was not a synonym of *Dicrotendipes*, and that *Carteronica longilobus* did not belong with those Afrotropical species previously considered to belong to *Carteronica*. Cranston et al. (1990) showed that *C. longilobus* was best placed in *Kiefferulus* Goetghebuer, 1922; *Carteronica* became a junior synonym of *Kiefferulus*.

Based on the morphology of the adult genitalia and the immature stages, the Afrotropical species '*Dicrotendipes multispinosus* (Freeman, 1957) and '*D. penicillatus* (Freeman, 1957) require establishment of a new genus. Similarities in the adult genitalia, and to a

lesser extent coloration, between these two species and '*D. crispus*' (Freeman, 1957) and '*D. regalis*' (Goetghebuer, 1936) allow the latter two species to also be included in this grouping. In this paper, the new genus name *Acinoretracus* is proposed for those four Afrotropical species removed from *Dicrotendipes*. The adult stages are redescribed, and the pupa and larva described for the first time, for *A. multispinosus* and *A. penicillatus*.

METHODOLOGY

Morphological terminology and abbreviations follow Sæther (1980), Epler (1988) and Langton (1994). For the anteromedian circular area of thinner cuticle on the larval frontal apotome we adopt the term apotomal fenestra, as suggested by Epler in Cranston (1996). This structure is distinct from the frontal pit found in *Dicrotendipes*, although some *Dicrotendipes* (and other genera, such as *Glyptotendipes*) may possess an apotomal fenestra (see Cranston 1996 and Epler 1987, 1988).

Other abbreviations used: BMNH = British Museum (Natural History).

Measurements are in μm , unless otherwise stated, and consist of the range followed by the mean if more than three specimens were measured. In the description of *Acinoretracus multispinosus*, data from Amakye & Sæther (1993) are included in brackets ([]) if they were outside of the range of the measurements performed in this study; some data from their redescription are also incorporated into the description of the genus below.

SYSTEMATICS

Acinoretracus Epler, Harrison et Hare gen. n.

Type-species: *Chironomus (Carteria) regalis* Goetghebuer, 1936: 465, by present designation.

Etymology

An anagram of *Carteronica*. Gender masculine.

Adult male

Medium-sized species, wing length about 1.6-3.0 mm; general colouration yellowish-brown to brown, thorax with dorsal median dark stripe extending from front to postnotum; abdomen with darker posterior bands and/or median lines/triangles or almost completely dark; wings unmarked.

Head. – Eyes bare, with dorsomesal extension. Temporal setae uniserial, beginning mesad to dorsomesal eye extension and running behind the eyes. Antennae with 11 flagellomeres; AR about 2.0-3.0. Frontal tubercles minute/vestigial. Clypeus subquadrate, setose.

Cibarium with internal sensillae. Maxillary palp with 5 palpomeres, palpomere 1 weakly sclerotized; palpomere 3 with 5-8 subapical sensilla clavata.

Thorax. – Antepronotum bare, lobes dorsally divided. Scutum not extending over antepronotum, scutal tubercle not present. Humeral pit obsolete; thoracic scar moderately developed. Acrostichal setae long, beginning close to antepronotum, 6-20; dorsocentral setae 7-14/side, uniserial; prealar setae 4-6/side; with one supraalar seta/side. Scutellum with 6-17 setae, uni- or biserial.

Wing. – Membrane without macrotrichia, with moderate punctuation of microtrichia. Brachium with 2-3 setae and proximal and distal groups of sensilla campaniformia. Anal lobe well developed, apex of wing rounded or slightly truncate. Veins R, R1 and R4+5 with setae; squama with setae. Costa not extended. Apical and posterior subapical margin of wing with scale-like setae.

Legs. – Apex of foretibia with rounded scale, without spur; foretarsus without beard. Middle and hind tibiae each with two combs; middle combs each with 1 spur; hind combs with inner comb with 1 spur, outer with 1-6 spurs. Sensilla chaetica present on apical $\frac{2}{3}$ of metatarsus of middle leg, sometimes with sensilla chaetica on metatarsus of hind leg. Tarsal claws simple; empodium well developed; pulvilli small, simple, about $\frac{1}{2}$ length of claw.

Abdomen. – With moderate coverage of long setae, arranged in loosely transverse rows.

Hypopygium (figs. 1, 8). – Anal tergal bands strong, converging before anal point and continuing onto point as a ridge. Anal point broad or narrow, downturned apically and sometimes hooked. Median anal tergite setae present or absent between dorsal ridges at base of anal point, lateral setae present along base of anal point. Superior volsella with short to elongate cylindrical base, with dense apical brush of long, fine setae, without large sensilla chaetica (setae); apex sometimes bifid. Median volsella absent or present as small wart-like protuberance that bears 4-10 long setae. Inferior volsella with narrowed, upturned apex bearing several apical setae, volsella sometimes swollen dorsally before apex. Gonostylus semi-quadrate and bulbous, sometimes with weak crista ventralis and a moderately to well developed thinner outer heel, or gonostylus more elongate and strongly curved medially, without crista ventralis or apical heel.

Adult female

As in the male, with following differences:

Head. – Antenna with 5 flagellomeres; AR about 0.33-0.46.

Thorax. – With about 2 humeral setae (anterior-most dorsocentral setae).

Wing. – Slightly stouter than in male, with more

setae on veins.

Genitalia (figs. 11, 12). – Gonocoxite IX vestigial, without setae. Gonapophysis VIII with well developed dorsomesal and ventrolateral lobes. Apodeme lobe well developed, with dense microtrichia. Labia without microtrichia. Seminal capsules ovoid with a short neck; spermathecal ducts without loops or bends.

Pupa

Exuviae brown, margins darker.

Cephalothorax. – Cephalic tubercles low, rounded; frontal setae small (fig. 15). Dorsum mostly smooth, with longitudinal row of tubercles, some of which are sharply pointed. Thoracic horn plumose; base reniform, with anteriorly directed flange-like lobe, with 2 tracheal bundle scars (fig. 17). Dorsal anteprenotal seta short, ventral seta long and taeniate. Anterior precorneal seta very long and taeniate, posterior seta short (fig. 17). Four dorsocentral setae; Dc1 and Dc2 close, Dc3 and Dc4 close; Dc1 and Dc4 thicker than Dc2 and Dc3.

Abdomen (fig. 18). – An uninterrupted row of posterior hooklets on T II, about $\frac{1}{2}$ width of segment. S II and III with posterior transverse medial band of long spines. Pedes spurii A present on S IV; pedes spurii B absent. Segment VIII with dark caudolateral combs, with 1-4 large spurs and 1-5 smaller spurs or spines; without ventral tubules. Setation: Each side of segment I with 1 lateral seta; II-IV with 3 lateral setae; V-VII with 4 lateral taeniae, these arranged with first two closer together on anterolateral margin and last two closer together on posterolateral margin; VIII with 5 lateral taeniae; anal lobe with a pair of dorsal taeniae and a biserial fringe of about 80-130 taeniae/side. Tergites and sternites with one pair of 0-setae. Shagreen: T I bare; T II-V (VI) with a mostly continuous field of points which become progressively larger posteriorly, weaker towards midline so that posterior points appear in two groups, on T III-VI these posterior shagreen groups slightly elevated above rest of integument; T VI sometimes with anterior and posterior fields of points, largest points in posterior portion of posterior field; T VII-VIII with anterior pair or transverse band of points, weaker on T VIII; anal disc without shagreen. Conjunctives III-IV, IV-V, V-VI with fine spinules. Pleura of II-III (IV) with longitudinal bands of fine to coarse spinules. S I bare; S II-V with scattered fine spinules; S VI-VII (VIII) with anterior patches of fine spinules.

Larva

Head capsule yellow/yellow-brown, with darker posterior margin, mentum, premandibles and mandibular teeth. Two pairs of eyespots. Body usually whitish in life but some specimens with red pigment; claws brown.

Head. – Antenna (fig. 30) with 5 segments. Ring organ in basal third of basal segment. Antennal blade shorter than flagellum; accessory blade short, about $\frac{1}{3}$ length of segment 2. Style and Lauterborn organs present at apex of segment 2.

Dorsum of head either with frontoclypeal apotome and labral sclerite 2 (fig. 26), or frontal apotome and labral sclerites 1 and 2, with anterior margin of frontal apotome indistinct (fig. 23); apotome with anteromedian fenestra. Labrum (fig. 28) with S I plumose on inner side only; S II simple and on short pedestal; S III simple; S IVA minute, 2-segmented; S IVB simple, shorter than S IVA. Labral lamella with marginal fringe. Pecten epipharyngis simple, with 9-16 pointed teeth, no teeth on surface. Premandible (fig. 31) with 5-6 teeth, brush well developed.

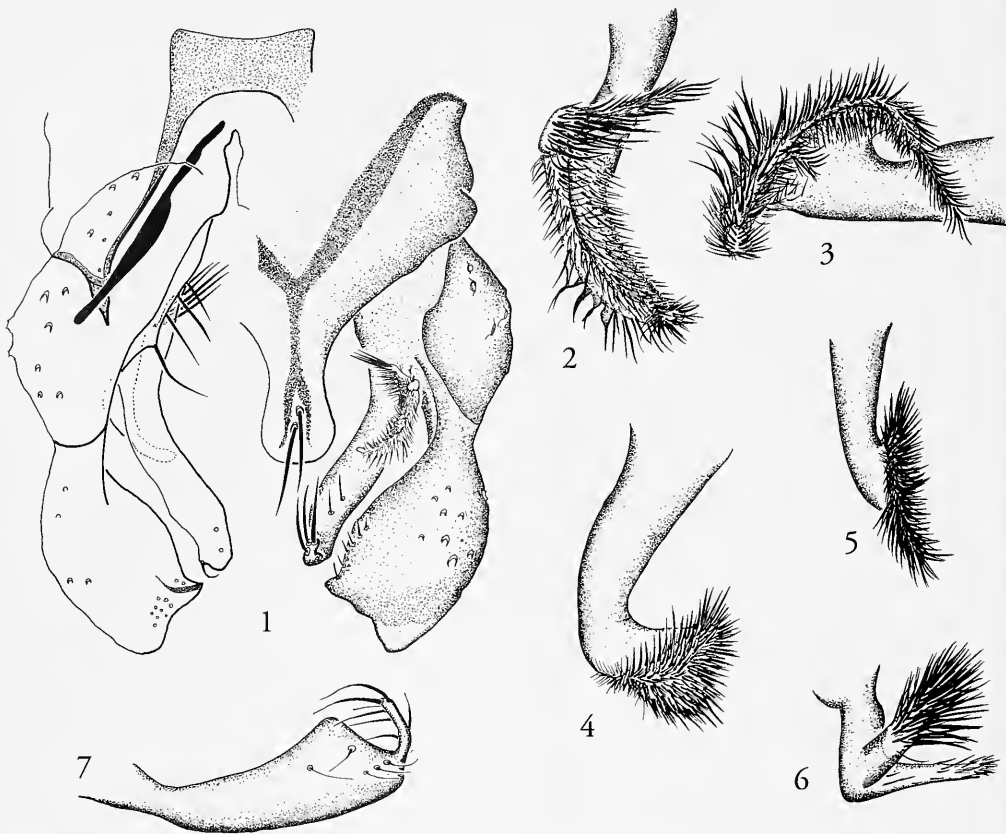
Mandible (fig. 32) with rugose outer margin, a pale dorsal preapical tooth and dark apical and three inner teeth. Pecten mandibularis composed of about 12 coarse setae arranged in U shape. Seta subdentalis (fig. 33) apically widened with numerous fine apical teeth. Seta interna plumose, with four main branches.

Mentum (figs. 24, 27) with 13 teeth, median tooth trifid and lower than first lateral teeth; first lateral teeth separate from seconds. Ventromental plates short and wide, 3.5- 4.0 \times wider than long, contiguous or nearly so medially; with smooth anterior margin; most striae complex, fork-like, with several branches arising from base of each stria (fig. 25); innermost and outermost striae simple. Setae submenti simple, at base of ventromental plates. Maxilla (fig. 29) without serrate lacinial chaetae; maxillary palp about twice as long as wide and with very long a seta. Triangulum occipitale wide.

Body. – Anterior parapods with simple and pectinate claws; posterior parapod claws simple. Lateral and ventral tubules absent. Procerci slightly longer than wide, each with 2 minute basal setae and 7-8 moderately long apical setae. Supraanal setae fine, slightly shorter than anal tubules. Two pairs of anal tubules, about 3 \times as long as wide.

Remarks

When all life stages are considered, *Acinoretracus* can be seen to be very close to *Kiefferulus*, not *Axarus* or *Lipiniella* as suggested by Hare in Cranston, et al. (1990). *Kiefferulus* has recently been expanded by the inclusion of several species previously assigned to other genera (Cranston et al. 1990); they (ibid.: 421) presented an emended diagnosis for the genus. Note that in their listing of included species, the authors omitted the South African species *K. nigropunctatum* (Freeman, 1957) (O. A. Sæther personal communication), *K. modocensis* (Sublette, 1960), a western Nearctic species; and Epler (1995) recently moved *Chironomus pungens* (Townes, 1945), an eastern Nearctic



Figs. 1-7 *Acinoretracus multispinosus*, adult male. — 1, Hypopygium; 2, left superior volsella, dorsal; 3, left superior volsella, lateral aspect of fig. 2; 4, left superior volsella, dorsal; 5, left superior volsella, dorsal; 6, left superior volsella of holotype, dorsal; 7, inferior volsella, lateral.

species, to *Kiefferulus*. The diagnosis of Cranston et al. (1990) is already in need of further emendation, for, as noted below, an undescribed southern Nearctic species of *Kiefferulus* has been found in which the larval ventromental plates are contiguous medially. One of us (ADH) is not in complete agreement with their synonymy of some African *Nilodorum* species with *Kiefferulus*.

While some life stages (the female) of *Acinoretracus* may not be clearly separable from *Kiefferulus* as currently defined, the complete suite of characters taken from all life stages demonstrates the generic uniqueness of *Acinoretracus* from *Kiefferulus*. These differences include:

Adult male: superior volsella with dense apical brush of long, fine setae, without large setae; inferior volsella with narrowed, upturned apex bearing several apical setae. No described species of *Kiefferulus* pos-

sesses such genitalia. Two species, *A. multispinosus* and *A. regalis*, possess a rudimentary median volsella that bears several large setae.

Adult female: gonocoxite IX vestigial, without setae. Sæther (1977: 170) describes the female genitalia of *Kiefferulus* with gonocoxite IX 'small, with about 2 setae'. However, Cranston et al. (1990: 423) noted that in *K. longilobus* gonocoxite IX is small and apparently without setae; while Harrison (1996: 10) found 'gonocoxite IX large with about 10 setae' in *K. chloronotus* (Kieffer).

Pupa: cephalic tubercles low, rounded; thoracic horn base with anteriorly directed flange-like lobe; long, taeniate ventral anteprenotal and anterior pre-corneal setae; pedes spurii B and larval ventral tubules absent. Note that while in Holarctic *Kiefferulus* the precorneal setae are subequal, in the Afrotropical

species *K. fractilobus* (Kieffer), the posterior pre-corneal seta is much larger and taeniate (JHE, unpublished data based on rearings from Nigeria by LH).

Larva: S 1 plumose on inner side only; mentum with first and second lateral teeth not fused; short and wide, contiguous ventromental plates, with forked striae; mandible with rugose outer margin and U shaped pecten mandibularis; ventral tubules absent. Pinder & Reiss (1983) and Cranston et al. (1990) diagnose *Kiefferulus* larvae as having medially separated ventromental plates. However, an undescribed southern Nearctic species (*Kiefferulus* sp. A in Epler 1992, 1995) has contiguous ventromental plates. This species has been reared by JHE and has a pupa and adult very similar to *K. dux* (Johannsen). Note that the ventromental plate striae of *K. sp. A* are simple, not forked as in *Acinoretracus* (fig. 25).

It can be hypothesized that *Acinoretracus* and *Kiefferulus* form a sister group within the *Chironomus* group (as defined by Epler 1988: 194), but the nature of the relationships between *Kiefferulus* and related genera must await a world-wide revision of *Kiefferulus*, utilizing characters from all life stages.

Acinoretracus multispinosus (Freeman) comb. n.
(figs. 1-7, 14, 17-22, 23-25)

Chironomus (*Dicortendipes*) *multispinosus* Freeman 1957: 373 (original description of adult male).

Dicortendipes multispinosus (Freeman). Freeman & Cranston 1980: 190 (catalog).

'*Carteronica multispinosus* Freeman. Cranston et al. 1990 (larval ventromental plates).

Dicortendipes multispinosus (Freeman). Amakye & Sæther 1993 (redescription of adult male; description of adult female).

Description

The male of this species was recently redescribed by Amakye & Sæther (1993); they also described the female in detail. Some of their data are included below in brackets in the descriptions of those life stages.

Adult male (n=4-5). – Colour. Head yellowish-brown, antennae light brown; thorax yellowish with dark median stripe extending from front of scutum to postnotum; wings unmarked, pale yellowish-brown; haltere pale; legs yellowish with femoral apices brown, bases and apices of tibiae brown; abdomen yellowish with brown posterior triangular areas/bands, tergite VIII and hypopygium almost completely brown.

Length. Total 3.63-4.60, 4.21 mm [3.31-4.48, 3.98 mm]; thorax 0.90-1.03, 1.02 mm; abdomen 2.73-3.58, 3.19 mm.

Head. Frontal tubercles 2.5 long. Temporal setae

12-19; clypeal setae 12-23, 18; cibarial sensilla 4-8. Lengths of palpomeres 1-5: 43-50 [30-56, 44]; 45-47 [37-52, 47]; 128-150 [135-168, 152]; 145-165 [150-179, 165]; 200 [233-248, 235]. AR 2.79-2.78 [2.28-2.60, 2.48].

Thorax. Setae: acrostichals 7-18[6-9, 8]; dorsocentrals 10-11, 10 [7-14, 9]; prealars 5 [4-5, 5]; scutellars 8-16 [6-12, 9].

Wing. Wing length 1.63-2.10, 1.86 mm [1.74-2.02, 1.88 mm]; width 0.44-0.61 mm. VR 1.16-1.24. Setae: R 20-34; R1 17-26; R4+5 20-39; squama 4-9 [6-10]. Wing apex rounded (fig. 14).

Legs. Tarsomere 1 of middle leg with 7-10 sensilla chaetica; tarsomere 1 of hind leg with 0-1 sensilla chaetica. Lengths and proportions of legs see Table 1.

Hypopygium (fig. 1). Superior volsella cylindrical, shaft bare but with expanded pad with dense brush of long setae apically (figs. 4, 5), or apex bifid (figs. 2, 3, 6). Median volsella reduced to small protuberance, with [4]5-10, 7 large anteromedially directed setae. Inferior volsella with narrowed, upturned apex, bearing 3-7 large setae and several smaller setae; volsella dorsally expanded preapically (fig. 7). Gonostylus bulbous/quadrated, with crista ventralis. Anal point ridge bearing 2-5 setae; anal point with 8-12 smaller lateral setae.

Adult female (n=1). – Colour. Similar to male.

Length. Total 4.00 mm [4.62 mm]; thorax 1.15 mm; abdomen 2.85 mm.

Head. Frontal tubercles 2.0 long. Temporal setae 16; clypeal setae 18; cibarial sensilla 14. Lengths of palpomeres 1-5: 45 [56]; 52 [56]; 150 [180]; 155 [184]; 250 [263]. AR 0.46 [0.45].

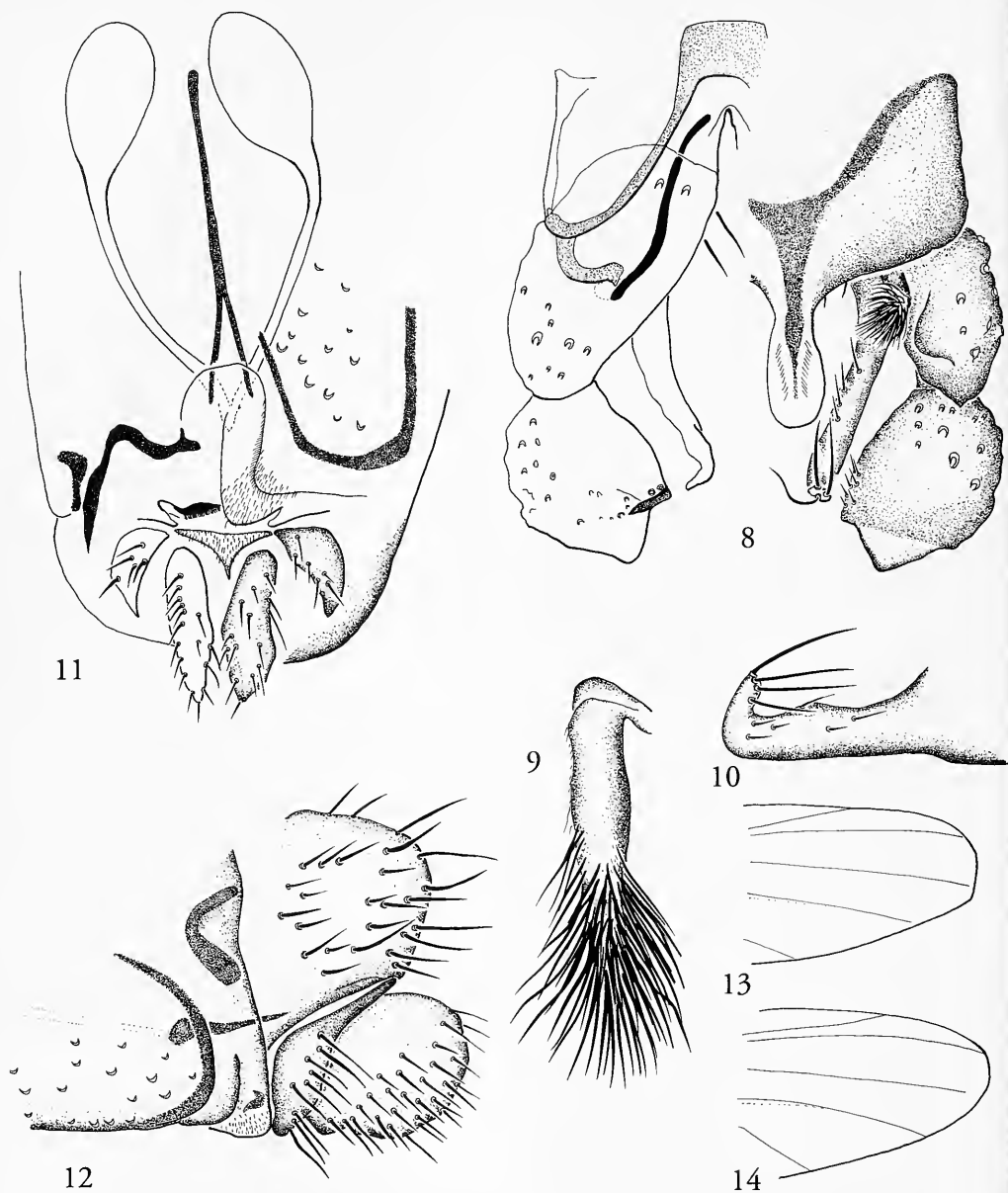
Thorax. Setae: acrostichals 14; dorsocentrals 11 + 2 humerals [16], 10; prealars 5; scutellars 15 [13].

Wing. Wing length 1.90 mm; width 0.65 mm. VR 1.17 [1.19]. Setae: R 31; R1 31; R4+5 42; squama 14 [12].

Legs. Tarsomere 1 of middle leg with 19 sensilla chaetica; tarsomere 1 of hind leg with 10 sensilla

Table 1. *A. multispinosus* male: lengths and proportions of legs (n = 1-2).

	P1	P2	P3
fe	[942] 1060-1160	[887] 1000-1070	[867] 1020-1100
ti	[638] 740-810	[742] 890	[943] 1100-1150
ta1	[1420] 1480	[457] 520	750
ta2	[667] 690	[220] 230	400-420
ta3	[581] 610	[157] 170-180	320-330
ta4	570	[95] 110-120	175-190
ta5	240	[57-67] 85-100	100-120
LR	2.00 [2.22]	0.58-0.63 [0.71]	0.68-0.73
BV	1.55	3.83-4.24	2.76-3.04
SV	1.22 [1.15]	[3.35] 3.50-3.63	2.68-2.83



Figs. 8-13. *Acinoretracus penicillatus*, adult male and female. – 8, Hypopygium; 9, superior volsella; 10, inferior volsella, lateral; 11, female genitalia, ventral; 12, female genitalia, lateral; 13, wing apex. – Fig. 14. *A. multispinosus*, wing apex.

chaetica. Lengths and proportions of legs see Table 2.

Abdomen. Notum 150 [128] long. Tergite X with 8 setae. Cercus 125 [145] long.

Pupa (n=4-6). – Colour. Exuviae light brown, with clear band at posterior margin of T (II) III-V, T VI-VIII and anal lobes paler brown.

Length. Total 4.55-5.52, 5.10 mm; cephalothorax 1.25-1.38, 1.33 mm; abdomen 3.30-4.15, 3.78 mm.

Cephalothorax. Frontal setae 30-35, 32 long. Dorsal anteprenotal seta 80-100 long, thin (n=2); ventral anteprenotal seta at least 113 long, taeniate (n=1). Anterior precorneal seta around 195-238 long, taeniate; posterior seta about 15 (broken?). Dorsocentral setae lengths (n=1): Dc1 48; Dc2 83; Dc3 45; Dc4 33. Dorsum with row of 7-11, 9 tubercles.

Abdomen (fig. 18). T II with posterior row of 22-27, 25 hooklets. S II (fig. 19) with posteromedian row of 33-54, 46 spines; S III with posteromedian row of 3-15, 10 spines. Shagreen on T II-VI with spinules larger anteromedially, followed posteriorly by smaller spinules which become progressively larger posteriorly, with posterior groups of larger spines separated medially by area of much smaller spinules; shagreen area on T II consists of a small rectangular area and two anterolateral patches, these patches sometimes joined with median patch to form broad T-shaped area; on T III-V shagreen broadly quadrilateral or X-shaped, with small fenestrations; on T VI broadly triangular; on T VII with two anterolateral patches or patches joined to form band; T VIII with two small anterolateral patches of fine spinules or sometimes with two longitudinal bands of fine spinules. T VIII with 1-3 large and several smaller caudolateral spurs (figs. 20-22). Anal lobes with 96-128, 113 taeniae.

Larva (n=4-5). – Colour. Head capsule light yellow-brown.

Head. Postmentum length 185-202, 191. Frontal apotome and labral sclerite 1 not fused but anterior margin of apotome not distinct, apotome weakly pebbled (fig. 23). Length of antennal segments 1-5: 68-85, 76; 22-30, 28; 11-15, 14; 7-8, 8; 5-7, 6; AR 1.08-1.40, 1.26. Premandible 80-93, 86 long. Pecten epipharyngis with 13 teeth (n=2). Mandible length 158-172, 167; pecten mandibularis with 11-14, 13 setae. Mentum (fig. 24) width 115-125, 121. Ventromental plates 158-175, 166 wide; 43-47, 45 long; VPR 3.51-3.84, 3.73; with 41-52, 48 striae.

Remarks

Freeman (1957: 373) stated the superior volsella of *multispinosus* was bifid. However, in many specimens the apex is not bifid, but pad-like with a dense brush of setae (figs. 4, 5; see also Amakye & Sæther 1993: figs. 2F, 2J, 2K). In the holotype specimen and three

Table 2. *A. multispinosus* female: length and proportions of legs (n=1).

	P1	P2	P3
fe	[1040] 1060	[973] 1000	[983] 1040
ti	720 [756]	[860] 880	[1068] 1080
ta1	1460	480	690
ta2	630	210	370
ta3	560	160	310
ta4	560	110	190
ta5	220	100	115
LR	2.03	0.55	0.64
BV	1.64	4.07	2.85
SV	1.22	3.92	3.07

of the five males associated with immature stages from Nigeria, one a pharate male still within its pupal skin, the apex of the volsella is bifid (figs. 2, 3, 6). In another pharate male pupa, the superior volsellae were broadly setose, similar to fig. 4. No other differences were noted among the adults, and no differences were noted in the immature stages between those adults with apically bifid or pad-like superior volsellae.

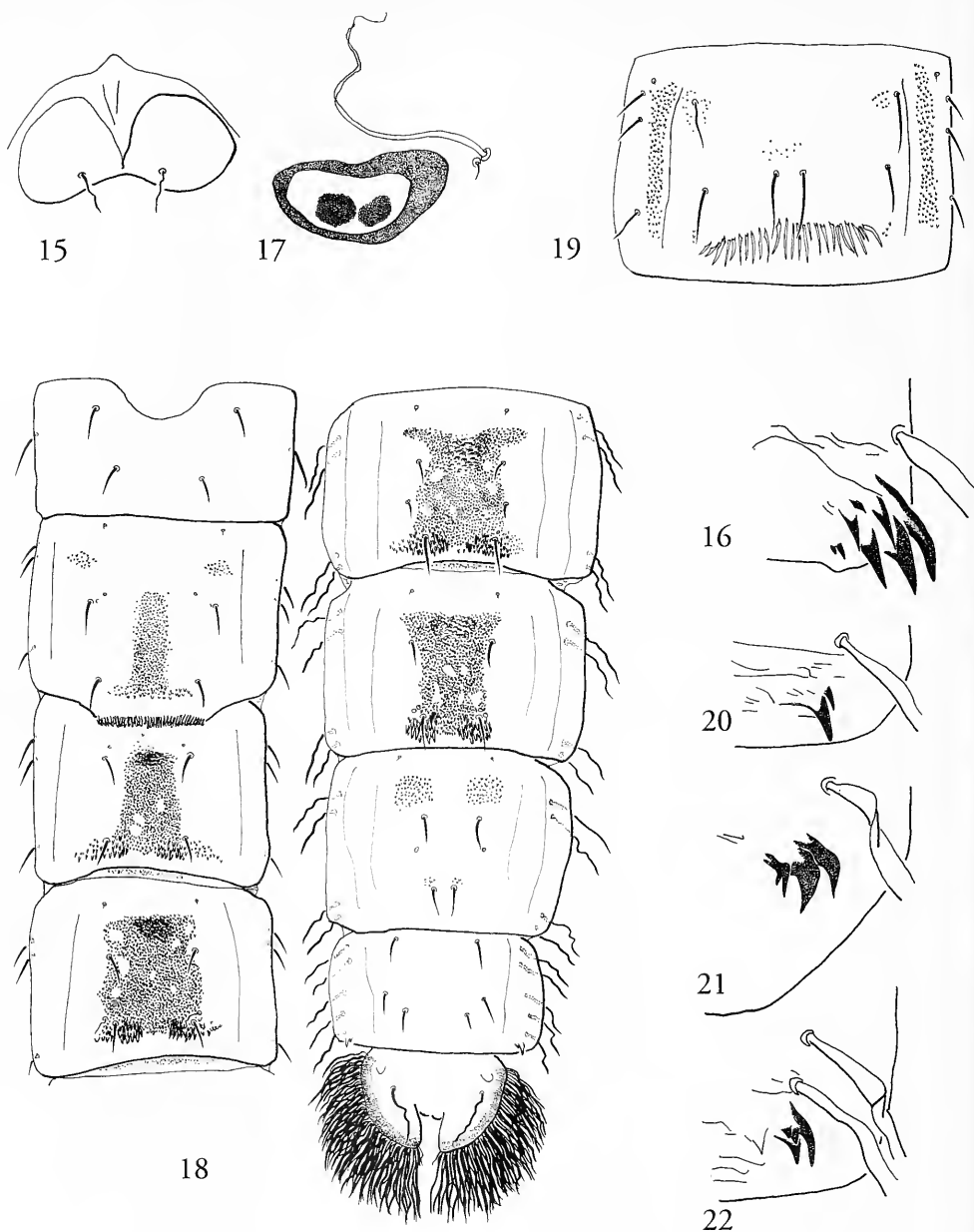
In *Acinoretracus multispinosus* and *A. regalis* a small, median protuberance, which bears several large setae, is present above the base of each inferior volsella. Amakye & Sæther (1993) termed the protuberance a median volsella; this structure is absent in *A. crisp*i and *A. penicillatus*.

Amakye & Sæther (1993: 269, 272) refer to a 'more or less distinct crista dorsalis' on the gonostylus of *multispinosus*. However, this ridge-like structure is actually ventral and could be termed a crista ventralis. This structure is also present on *A. regalis* and *A. penicillatus*.

See Remarks under *A. regalis* for comments concerning the separation of *A. multispinosus* and *A. regalis*.

Pupae of this species and *A. penicillatus* may prove difficult to separate. In general, the pupa of *A. penicillatus* is larger (5.53-5.91 mm vs. 4.55-5.53 mm in *A. multispinosus*) and has a higher T II hooklet count (26-30 vs. 22-27 in *A. multispinosus*) but fewer anal lobe taeniae (84-100 vs. 96-128 in *A. multispinosus*). These numbers may prove meaningless when more populations are sampled; our sample is admittedly small. The shagreen spinules on T II-VI are larger anteromedially in *A. multispinosus*; in *A. penicillatus* they are subequal anteromedially. Another useful character for separation is the presence of larger anterior and posterior triangular clear areas on T VII-VIII on *A. penicillatus*; such areas are reduced or not present on our *A. multispinosus* material.

Larvae of *A. multispinosus* are very similar to *A. penicillatus*. In our material, fourth instar *A. multispinosus* larvae were smaller; however size differences may not hold throughout the species' range and in general may not provide a good character for separa-



Figs. 15-16. *Acinoretracus penicillatus* pupa. – 15, Cephalic tubercles; 16, tergite VIII caudolateral spurs. – Figs. 17-22. *A. multispinosus*, pupa. – 17, Thoracic horn base and precorneal setae; 18, abdomen, dorsal; 19, sternite II; 20-22, tergite VIII caudolateral spurs, variations.

tion. A good distinguishing feature is the well defined labral sclerite 1 of *A. multispinosus*; in *A. penicillatus* this sclerite is fused with the frontal apotome.

The immature stages of *A. multispinosus* described in this paper were collected from Lake Opi, a shallow (maximum depth 4 m), slightly acidic (pH 6.0-6.5) and dilute (low in dissolved minerals) body of water in the West African Guinea Savanna region near Nsukka, Nigeria. Larvae of *A. multispinosus* were uncommon at depths greater than 0.5 m in this lake (Hare & Carter 1986). For more detailed information on the chemistry of Lake Opi see Hare & Carter (1984).

The species is known from Burkina Faso, Cameroon, Chad, Ghana, Nigeria, Uganda and Zaïre.

Material examined. – [BURKINA FASO] Haute Volta, a.o.f., Tangrela, 3-12-56, Cercle de Banfora, J. Hamon, ORSTOM réc., 1 ♂ paratype (BMNH). CAMEROON: Kumba, vi-vii-58, D. J. Lewis, 1 ♂ (BMNH). NIGERIA: Lake Opi nr. Nsukka, 8-iii-1977 to 6-viii-1980, leg. L. Hare, numerous associated adults, pupal exuviae and larvae. UGANDA: Lake Bungani, 1-viii-1932, G. H. E. Hopkins, holotype ♂ (BMNH).

***Acinoretracus penicillatus* (Freeman) comb. n.**
(figs. 8-13, 15, 16, 26-33)

nec *Carteria regalis* Goetghebuer. Freeman 1955: 371. [mis-identification].

Chironomus (Dicrotendipes) penicillatus Freeman 1957: 374 (original description of adult male).

Dicrotendipes penicillatus (Freeman). Freeman & Cranston 1980: 190 (catalog).

Description

Adult male (n=3). – Colour. Head and antennae light brown; thorax brown, with dark median stripe extending from front of scutum to postnotum; legs brown; wings unmarked, pale brownish; abdomen brown, tergites I-VI with central dark stripe, VII, VIII and hypopygium uniform brown.

Length. Total 4.15-4.90 mm; thorax 1.05-1.15 mm; abdomen 3.10-4.90 mm.

Head. Frontal tubercles 2.0 long. Temporal setae 11-15; clypeal setae 18-22; cibarial sensilla 11-18. Lengths of palpomeres 1-5: 30-33; 42-45; 108-113; 105-125; 154-170. AR 1.95-2.08.

Thorax. Setae: acrostichals 11-13; dorsocentrals 10-11; prealars 5-6; 7-8.

Wing. Wing length 2.00-2.03 mm; width 0.50-0.54 mm. VR 1.16-1.20. Setae: R 25-30; R1 13-19; R4+5 20-23; squama 6-7. Wing apex slightly truncate (fig. 13).

Legs. Tarsomere 1 of middle leg with 8-13 sensilla chaetica; tarsomere 1 of hind leg with 0 sensilla chaetica. Lengths and proportions of legs see Table 3.

Hypopygium (fig. 8). Superior volsella digitiform,

shaft bare but with dense brush of long setae apically (fig. 9). Median volsella absent. Inferior volsella with narrowed, upturned apex, bearing 3-4 large setae and several smaller setae (fig. 10). Gonostylus bulbous/quadrated, with crista ventralis. Anal point ridge without dorsal setae; anal point with 3-6 smaller lateral setae.

Adult female (n=1-2). – Colour. Similar to male.

Length. Total 3.77-4.26 mm; thorax 1.12-1.28 mm; abdomen 2.65-2.98 mm.

Head. Frontal tubercles vestigial. Temporal setae 13-17; clypeal setae 22-32; cibarial sensilla 17-18. Lengths of palpomeres 1-5: 38-40; 40-43; 100-112; 108-117; 177-185. AR 0.33.

Thorax. Setae: acrostichals 13-14; dorsocentrals 10-11 + 2 humerals; prealars 5; scutellars 8.

Wing. Wing length 2.18-2.35 mm; width 0.63-0.70 mm. VR 1.14-1.16. Setae: R 31; R1 20-23; R4+5 35-41; squama 9-10.

Legs. Tarsomere 1 of middle leg with 21-23 sensilla chaetica; tarsomere 1 of hind leg with 0 sensilla chaetica. Lengths and proportions of legs see Table 4.

Abdomen. Notum 155 long. Tergite X with 10-11 setae. Cercus 113 long.

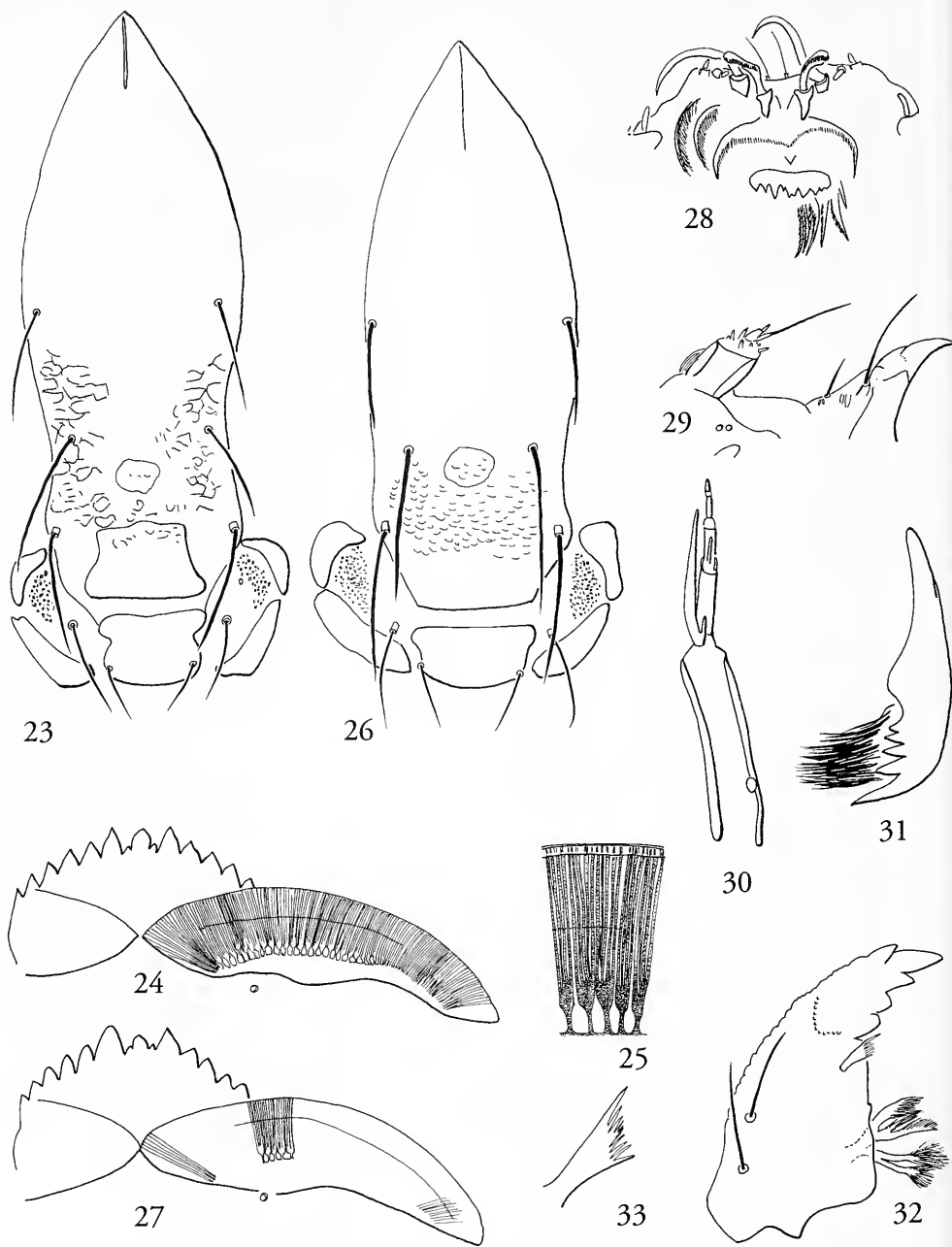
Pupa (n=3-4). – Colour. Exuviae brown, with clear band at posterior margin of T II-VI, T VII-VIII with clear anterior and posterior triangular areas; anal lobes paler brown.

Table 3. *A. penicillatus* male: lengths and proportions of legs (n = 2-3):

	P1	P2	P3
fe	990-1040	920-950	1020-1040
ti	745-760	860-880	1140-1160
ta1	1130-1150	400-420	690-700
ta2	530-540	220-240	410-420
ta3	475-480	190-195	330-340
ta4	380	120	190
ta5	180-185	95-100	115-120
LR	1.49-1.54	0.47-0.48	0.60-0.61
BV	1.83-1.86	3.38-3.60	2.71-2.73
SV	1.55	4.36-4.45	3.13-3.14

Table 4. *A. penicillatus* female: lengths and proportions of legs (n=2-3).

	P1	P2	P3
fe	1000	960	1000-1090
ti	760	910	1120-1220
ta1	1250	460	680-710
ta2	540	230	345-400
ta3	460	190	320-330
ta4	360	120	180
ta5	180	100	120
LR	1.64	0.51	0.58-0.61
BV	1.95	3.64	2.90-2.93
SV	1.41	4.07	3.12-3.25



Figs. 23-25. *Acinoretracus multispinosus* larva. – 23, Apotome and labral sclerites; 24, mentum and ventromental plate; 25, detail of ventromental plate striae. – Figs. 26-33. *A. penicillatus*, larva. – 26, Apotome and labral sclerites; 27, mentum and ventromental plate; 28, labral structures; 29, maxilla; 30, antenna; 31, premandible; 32, mandible; 33, seta subdentalis.

Length. Total 5.53-5.95 mm; cephalothorax 1.30-1.38 mm; abdomen 4.20-4.65 mm.

Cephalothorax. Frontal setae 30-50, 38 long. Dorsal anteprenotal seta not measurable (broken off?); ventral anteprenotal seta at least 150 long, taeniate ($n=1$). Anterior precorneal seta not measurable, taeniate; posterior seta about 80. Dorsocentral setae lengths ($n=2-3$): Dc1 40-50; Dc2 100; Dc3 21-33; Dc4 40-43. Dorsum with row of 11-17, 13 tubercles.

Abdomen. T II with posterior row of 26-30, 28 hooklets. S II with posteromedian row of 27-36, 33 spines; S III with posteromedian row of 10-15, 13 spines. Shagreen on T II-VI becomes progressively larger posteriorly, with posterior groups of larger spines separated medially by area of smaller spinules; on T II consists of broad T- or V-shaped area; on T III- T V shagreen broadly quadrilateral or X-shaped, with small fenestrations; on T VI broadly triangular; on T VII with two anterolateral patches or patches joined to form band; T VIII with two anterior patches of fine spinules. T VIII with 3-4 large and several smaller caudolateral spurs (fig. 16). Anal lobes with 84-100, 92 taeniae.

Larva ($n=3$). — Colour. Head capsule yellow-brown.

Head. Postmentum length 235-260. Frontal apotome and labral sclerite 1 fused, apotome strongly pebbled (fig. 26). Length of antennal segments 1-5: 75-90; 28; 13-15; 10; 5; AR 1.19-1.48. Premandible 85-100 long. Pecten epipharyngis with 14-16 teeth ($n=2$). Mandible length 175-190; pecten mandibularis with 8-12 setae. Mentum (fig. 27) width 123-135. Ventromental plates 188-203 wide; 50-54 long; VPR 3.57-3.76; with 48-50 striae.

Remarks

See remarks under *A. multispinosus* for separation of the immature stages.

Our associated material was collected at the type-locality from bottom mud in acid, brown water dystrophic lakes and ponds at a depth of about 1.5 m; they were not collected in the marginal reeds. The small lake at Betty's Bay is described by Harrison (1958).

The species is known only from South Africa.

Material examined. — [SOUTH AFRICA]: Cape Province, Cape Peninsula, Hout Bay, Skoorsteenskop, 11-1951, P. Brinck, 1 ♂ paratype (BMNH). SOUTH AFRICA: Western Cape Province: Betty's Bay, Malgat Vlei, January and February 1994, leg. A.D. Harrison, numerous associated adults, pupal exuviae and larvae.

Acinoretracus regalis (Goetghebuer) comb. n.

Chironomus (*Carteria*) *regalis* Goetghebuer 1936: 465 (original description of adult male).

Chironomus (*Dicrotendipes*) *regalis* Goetghebuer. Freeman

1957: 373 (redescription).

Dicrotendipes regalis (Goetghebuer). Freeman & Cranston 1980: 190 (catalog).

This species is very similar to *A. multispinosus*, differing mainly in having a normal spur count on the hind tibial combs. Freeman (1957) stated that the two species could be separated by differences in the genitalia, such as the anal point being narrower in side view in *multispinosus* (this difference has been difficult to observe), more rounded gonostylus in *multispinosus* (Freeman himself stated that this difference may not be constant), and the bifid nature of the superior volsella in *multispinosus* (which, as discussed above, is not always bifid). The two species are so similar in structure that it may be that both are the same; *A. multispinosus* may only be a variety with extra spurs on the hind tibial comb. We have made *regalis* the type-species for the genus because it was the first described species; should *multispinosus* fall as a synonym, no name changes or change in type-species status would be necessary. Reared material and more adult material will be needed to solve the potential problem of separation of *regalis* from *multispinosus*. The immature stages of *A. regalis* are unknown.

The species is recorded from Burkina Faso, Ghana, Sierra Leone and Zaire.

Material examined. — [GHANA] Gold Coast: Addah, Adidome, 1921, N.L. Braybrock, in hut, 2 ♂ (BMNH). [ZAIRE]: Congo-Belge: Eala, 17-iv-1936, J. Ghesquière (label reads 'compared with holotype by P. Freeman 1955'), 1 ♂ (BMNH).

Acinoretracus crispus (Freeman) comb. n.

Chironomus (*Dicrotendipes*) *crispus* Freeman 1957: 374 (original description of adult male).

Dicrotendipes crispus (Freeman). Freeman & Cranston 1980: 190 (catalog).

This species differs from the other three in the genus by having a more slender and strongly curved gonostylus, long and slender superior volsella, and a narrow anal point that is sharply hooked apically (Freeman 1957: figs. 8g, 8j). The inferior volsella is similar to that of *A. penicillatus* in that it lacks the preapical dorsal swelling. The immature stages are unknown.

The species is recorded from Chad, Ghana, Mali, Nigeria and Sudan.

Material examined. — [GHANA]: Gold Coast: Red Volta, Nangodi, 8-x-1954, G. Crisp, 1 ♂ paratype (BMNH).

Key to adult males of *Acinoretracus*

1. Gonostylus broad, bulbous, semi-quadrate; superior volsella short; anal point broad (figs. 1, 8)2
- Gonostylus more slender, strongly curved; superior volsella long and slender; anal point slender (see Freeman 1957: figs 8f, 8j) *A. crisp*
2. Hind tibia with 1 spur on outer tibial comb3
- Hind tibia with 4-5 spurs on outer tibial comb... *A. multispinosus*
3. Median volsella present with 4-7 large setae; inferior volsella with dorsal subapical swelling (similar to figs. 1, 7; see also Freeman 1957: figs. 8d, 8h) *A. regalis*
- Median volsella absent; inferior volsella without subapical swelling or at most a slight dorsal expansion (figs. 8, 10) *A. penicillatus*

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A REVISION OF *EURYDIOPSIS* FREY (DIPTERA, DIOPSIDAE) WITH DESCRIPTION OF FOUR NEW ORIENTAL SPECIES

Feijen, Hans R., 1999. A revision of *Eurydiopsis* Frey (Diptera, Diopsidae) with description of four new Oriental species. – Tijdschrift voor Entomologie 141 [1998]: 221-240, figs.1-72, table 1. [ISSN 0040-7496]. Published 1 March 1999.

Eurydiopsis Frey is defined. Catalogue and key to the six species are given, while differential and quantitative characters are discussed. The earlier proposed synonymy between *E. subnotata* (Westwood) from the Philippines and *E. argentifera* (Bigot) from Indonesia and Malaysia is rejected. Both species are redescribed, whereas *E. helsdingeni* sp. n. from Indonesia (Java), *E. glabrostylus* sp. n. from the Philippines, *E. brevispinus* sp. n. from Laos and Myanmar and *E. sarawakensis* sp. n. from Malaysia (Sarawak) are described.

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Keywords. – Diopsidae; *Eurydiopsis*; catalogue; key; new species; redescriptions; Asia.

In 1928 Frey erected the subgenus *Eurydiopsis* in *Diopsis* Linnaeus 1775. As type-species *Diopsis subnotata* Westwood 1848 from the Philippines was designated. The only differential character indicated by Frey was constituted by the short and blunt facial teeth of the Oriental *Diopsis subnotata* and '*Diopsis circularis* Macquart' (sensu van der Wulp 1897), as opposed to the long and sharp facial teeth of the African *Diopsis*. However, many African *Diopsis* do not have facial teeth and it has been pointed out several times (e.g., Shillito 1971: 289, Feijen 1989: 14) that presence or absence of facial teeth cannot be used as a key character to distinguish a genus.

Feijen (1978) showed that *Diopsis circularis* Macquart 1835 represents an exclusively African species. The species identified as *Diopsis circularis* by van der Wulp (1897) and called *Eurydiopsis circularis* by Frey (1928) had to represent an undescribed Oriental species. Bigot (1874) described *Diopsis argentifera* from Celebes (Sulawesi), Indonesia. However, in 1881 Bigot placed his *Diopsis argentifera* in synonymy with *Diopsis subnotata*, quoting Osten Sacken who published the synonymy in 1882.

Séguy (1949) described two Malagasy diopsids as *Diopsis (Eurydiopsis) apollo* and *Diopsis (Eurydiopsis) apographica*. Later, Vanschuytbroeck (1965) described two more Malagasy species as *Eurydiopsis an-jahanaribe* and *Eurydiopsis vadoni*. Shillito (1971) thought it necessary to erect a new Malagasy genus

for these four '*Eurydiopsis*', but Steyskal (1972) placed all four Malagasy '*Eurydiopsis*' in *Cyrtodiopsis*. Cogan & Shillito (1980) agreed to the inclusion in *Cyrtodiopsis*. Feijen (1981), in a note on *Cyrtodiopsis*, considered Shillito's original view correct, while Feijen (1989) included the four species in *Eurydiopsis* S. & V. nec Frey, a genus still to be described. The Malagasy species can, for instance, be distinguished from *Eurydiopsis* by their distinct inner vertical bristle (usually on a cone) and the non-articulated gonostyli with an apodeme.

Burkhardt & de la Motte (1985: 205) expressed the view that *Cyrtodiopsis quinqueguttata* was more related to *Eurydiopsis argentifera* (as *subnotata*) than to any *Cyrtodiopsis*. Feijen (1989) agreed that *quinqueguttata* is an aberrant species, but doubted that it is more related to *Eurydiopsis* than to the other *Cyrtodiopsis*.

Steyskal (1972) elevated *Eurydiopsis* to genus level, while Feijen (1989) stated that a redescribed *Eurydiopsis* should be maintained as a separate genus. So far, this genus only counted the one recognized Oriental/Australasian species, but study of material from various countries showed *subnotata* to represent a species complex.

The material identified by van der Wulp (1897: 189) as '*circularis*' was rediscovered in the Leiden Museum and the Brussels Museum. It proved to represent an undescribed *Eurydiopsis*, clearly distinct from the *subnotata* complex. This new species is now described

as *E. helsdingeni*. The synonymy of *E. argentifera* with *E. subnotata* is rejected and *argentifera* is now recognized as a distinct species occurring in Sulawesi, Java, Sumatra and peninsular Malaysia. Three more species were recognized in the *subnotata* complex: *E. glabrostylus* sp. n. as the second species from the Philippines, *E. brevispinus* sp. n. from Laos and Myanmar and *E. sarawakensis* sp. n. from Sarawak, Malaysia.

A diagnosis of *Eurydiopsis*, a catalogue and a key to the six species are presented. The geographic distribution of the *Eurydiopsis* species is briefly discussed. The phylogeny and biology of the genus is reviewed. The phylogenetic position of the genus *Eurydiopsis* in the Diopsinae is not yet clear. A possible closer relationship with the *Diopsis indica* complex is summarily indicated. Various differential and quantitative characters are discussed.

ABBREVIATIONS USED

IVB	Inner Vertical Bristle
l/w	length/width
OVB	Outer Vertical Bristle
sc	scutellar
scsp	scutellar spines
SE	Standard Error
tub	tubercles

ACRONYMS FOR COLLECTIONS

BMNH	British Museum (Natural History), London
BPBM	Bernice P. Bishop Museum, Hawaii
IRSNB	Institut Royal de Sciences Naturelles de Belgique, Bruxelles
MLUH	Wissenschaftsbereich Zoologie, Sektion Biowissenschaften, Martin-Luther-Universität, Halle
RMNH	Nationaal Natuurhistorisch Museum, Leiden (formerly Rijksmuseum van Natuurlijke Historie)
UMO	Hope Entomological Collections, University Museum, Oxford
UZMH	Zoological Museum, University of Helsinki
ZMA	Zoologisch Museum, Amsterdam

GENUS EURYDIOPSIS FREY 1928

Eurydiopsis Frey 1928: 70 (as subgenus of *Diopsis*, type species *subnotata* Westwood by original designation); Shillito 1971: 288 (as subgenus); Steyskal 1972: 10 (as genus); Steyskal 1975: 33 (as genus); Feijen 1989: 62 (as genus).

Diagnosis

Large Diopsidae (7-13 mm) with relatively very small eye stalks (eye span less than $\frac{3}{4}$ of body length);

bipartite arista; medium-sized OVB, IVB a minuscule wart or a small bristle; facial sulcus present; facial teeth absent or very small and blunt (Feijen 1989 mentions 'no facial teeth' for *Eurydiopsis* in his key to the Diopsidae genera. This should be replaced by 'facial teeth absent or very small and blunt'); precoxal bridge present; supra-alar and infra-alar spines absent; scutal bristles absent; scutellar spines medium-sized to long, straight to simply curved; apical bristle absent; metapleural spines strong and laterally directed; thorax uniformly pollinose; front femora slender to incrassate with two long rows of tubercles, the outer row counting on the average 19-23 tubercles and the inner row 22-26; no apical spurs on femora 2 and 3; mid tibiae with two small subapical bristles; alula absent, sixth vein not extending beyond anal cell, fifth vein extending beyond posterior crossvein but not reaching wing margin; wings patterned with two rows of hyaline spots and hyaline apex or preapical band; abdomen moderately to strongly clavate; syntergum consisting of terga 1-3 or terga 1-4, seam between terga 2 and 3 distinct; spiracle 1 in tergum; female tergum 8 divided or not, female tergum 10 with 3 to 4 pairs of hairs; female spiracle 7 in membrane, female sternum 8 a single plate, sometimes strongly constricted medially; three smooth, rounded spermathecae; male sternum 5 divided or single; male sternum 6 divided; male sternum 7+8 a very short, band-like sclerite with spiracle 7 located anteriorly of it (fig. 26); periandrium short, rounded; gonostyli simple, fused to periandrium but appearing articulated; processus longi fused (running from gonostylus to gonostylus via edge of periandrium); phallapodeme simple; ejaculatory apodeme small; no sexual dimorphism in length of eye stalks and shape of front femora.

Catalogue

Eurydiopsis Frey, 1928: 70 (as subgenus of *Diopsis*).

Type species *subnotata* Westwood 1848, by original designation).

Ref.: Steyskal 1972: 10; Steyskal 1975: 33; Feijen 1989: 62.

argentifera Bigot, 1874: 112 (*Diopsis*).

Type locality: Celebes (Sulawesi), Indonesia.

Ref.: Bigot 1881: 373 (synonymy with '*subnitida*' Westwood, quoting Osten Sacken 1882). Two syntypes (as 'cotypes') in UMO.

brevispinus sp. n.

Type locality: Mt. Victoria, Myanmar. Holotype and 1 paratype in BMNH, 3 paratypes in MLUH.

glabrostylus sp. n. Type locality: Aroroy, Philippines. Holotype and 9 paratypes in UZMH. Ref.: Frey 1928: 71 (in part, as *subnotata*).

helsdingeni sp. n. Type locality: Java, Indonesia.

Holotype in RMNH, 2 paratypes in IRSNB, 1 paratype in MLUH.

Ref.: van der Wulp 1897: 189 (as '*Diopsis circularis*' Macquart); Frey 1928: 70 (as '*Diopsis circularis*' Macquart).

sarawakensis sp. n.

Type locality: Sarawak, Malaysia. Holotype in RMNH, 2 paratypes in BPBM.

'*subnitida*'; (Bigot 1881: 373, lapsus for *subnotata* Westwood).

subnotata Westwood, 1848, 37, pl. 18, fig. 2 (*Diopsis*).

Type locality: Philippines.

Ref.: Frey 1928: 71 (in part, others now included in *glabrostylus* sp. n.). Other records from India (Assam), Burma, Indonesia (Sumatra, Celebes) and New Guinea (Irian Jaya) are probably all misidentifications. Type (♀) in BMNH.

Distribution

So far the various *Eurydiopsis* species were all lumped under the name *E. subnotata*. This name was recorded from the Philippines (Westwood 1848: 37, Bezzi 1913: 328, Frey 1928: 71), Assam in India (Brunetti 1907: 164), Myanmar (Steyskal 1975: 33), Celebes, Java and Sumatra in Indonesia (Walker 1861: 263, van der Wulp 1896: 171, 1897: 192, de Meijere 1924: 60), mainland Malaysia (Tan 1965: 14, 1966: 133, 1967: 36; Burkhardt & de la Motte 1983: 99, 1985: 204) and New Guinea (Kertész 1899: 183). However, *Eurydiopsis subnotata* is now considered as a species which only occurs in the south-eastern islands of the Philippines. As a second species from the Philippines, *Eurydiopsis glabrostylus* is now recognized. This species occurs in the north/north-western islands of the Philippines. *Eurydiopsis argentifera*, formerly placed in synonymy with *E. subnotata*, is the most widely distributed species, occurring in Sulawesi (Celebes), Java, Sumatra and mainland Malaysia. Male genitalia of the various locations were compared (cf. figs. 1-3), but did not warrant the erection of more species. Given the distribution of *E. argentifera*, the possibility cannot be excluded that it also occurs in Borneo, as the second species of that island, besides the indigenous *Eurydiopsis sarawakensis* sp. n. The aberrant *Eurydiopsis helsdingeni* is the second species from Java, while *Eurydiopsis brevispinus* occurs in Laos and Myanmar. The *Eurydiopsis* recorded from Assam and from New Guinea are likely to represent additional undescribed species. Unfortunately, no material from these locations could be traced.

Phylogeny

Feijen (1989) discussed our present knowledge of the intrafamilial relationships of the Diopsidae. For the moment the Diopsidae are divided into the subfamilies Sphyracephalinae and Diopsinae. The Sphyr-

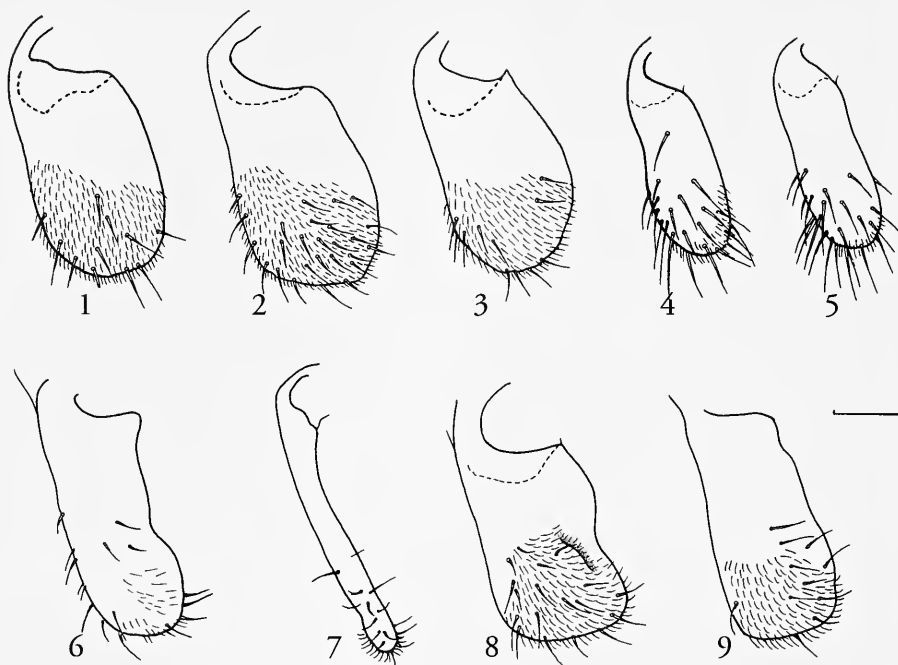
racephalinae are likely to represent a monophyletic group, but a proper groundplan with synapomorphic conditions cannot yet be presented. It remains to be seen whether the Diopsinae form a monophyletic group, and, as such, the sistergroup of the Sphyracephalinae. Feijen (1989) indicated a few possible groups of genera within the Diopsinae, but *Eurydiopsis* belongs to the genera of which the position within the Diopsinae remains unclear. In the key presented by Feijen (1989) *Eurydiopsis* keys out next to *Diopsis*, but this does not necessarily give an indication of a closer relationship.

As important plesiomorphic characters of *Eurydiopsis*, the following conditions can be given: absence of sexual dimorphism in length of eye stalks and shape of front femora, absence of facial teeth (or presence of very small rounded teeth) and presence of a distinct seam between terga 2 and 3 in the syntergum. A distinct seam between terga 2 and 3 in the syntergum further only occurs in *Diasemopsis* and *Sinodiopsis*, while in some species of the *Diopsis indica* complex a vague seam occurs.

As important apomorphic characters the absence of thoracic bristles and the very short, band-like male sternum 7+8 (fig. 26) can be mentioned. The only other genus in which no thoracic bristles occur is *Diopsis*. A reduced sternum 7+8 is only found in *Sphyracephala*, *Cladodiopsis*, *Eurydiopsis* and the *Diopsis indica* complex.

Intriguing is the occurrence of similar (subapical, central and proximal rows of irrorations) wing patterns in the genera *Diopsina*, *Sinodiopsis*, *Eurydiopsis*, *Teleopsis*, *Cyrtodiopsis* and *Eurydiopsis* S. & V. nec Frey. Feijen (1989) still assumed that these wing patterns did not indicate a common origin. However, the possibility cannot be excluded. Based on the common character of a very narrow male sternum 7+8, a closer relationship between *Eurydiopsis* and the *Diopsis indica* complex can also not yet be ruled out. It is doubtful that the *indica* complex will remain in a revised *Diopsis* genus.

Within *Eurydiopsis*, the *subnotata* complex and *E. helsdingeni* can be considered as sistergroups. As synapomorphic condition for the *subnotata* complex the slender to moderately incrassate front femora can be mentioned, while as apomorphic conditions for *E. helsdingeni* the fusion of tergum 4 to the syntergum, the glabrous wingbase and the divided male sternum 5 can be given. Within the *subnotata* group it is difficult to indicate relationships. It does not seem unlikely that *E. glabrostylus* and *E. brevispinus* are more closely related. This assumption is based on similar character states as the relative length of the scutellar spines, the ratio length/width of the gonostyli and the percentage coverage of the gonostyli with microtrichia (see table 1).



Figs. 1-9. Latero-ventral view of gonostylus. – 1, *Eurydiopsis argentifera*, Indonesia, Sulawesi, nr. Bantimurung; 2, *Eurydiopsis argentifera*, Indonesia, Java; 3, *Eurydiopsis argentifera*, Malaysia, Malaya (bred); 4, *Eurydiopsis brevispinus*, paratype, Myanmar, Mt. Victoria; 5, *Eurydiopsis brevispinus*, paratype, Laos, Pau; 6, *Eurydiopsis glabrostylus*, paratype, Philippines, Aroroy; 7, *Eurydiopsis helsdingeni*, paratype, Indonesia, Java; 8, *Eurydiopsis sarawakensis*, paratype, Malaysia, Sabah; 9, *Eurydiopsis subnotata*, Philippines, Surigao. Scale 0.1 mm.

Biology

Our knowledge of the biology of *Eurydiopsis* is mainly based on the studies of *Eurydiopsis argentifera* (as *subnotata*) by Burkhardt & de la Motte (1983: 99, 1985: 204), while a few observations were made by Tan (1965: 14, 1967: 36).

Among the Diopsidae the *Eurydiopsis* species are exceptional because of their size and weight. The Philippine *Eurydiopsis* are the largest (length of body) and heaviest diopsids known. However, there is nothing unusual about their eye stalks, which are, relatively, among the smaller ones in the Diopsidae. The absence of sexual dimorphism with regards to eye span and shape of femora is found in all *Eurydiopsis*. Burkhardt & de la Motte (1985: 204) also recorded *Eurydiopsis argentifera* (as *subnotata*) as a homomorphic species with a sex ratio of freshly emerged flies close to a 1 : 1 ratio.

Another remarkable feature of *Eurydiopsis* is their unusual life span. Burkhardt & de la Motte (1983: 99) mentioned a life span of almost one-and-a-half year for the Malayan *Eurydiopsis argentifera*.

Differential and quantitative characters

Measurements. – Within *Eurydiopsis* the two Philippine species, *E. glabrostylus* and *subnotata* are the large species, *argentifera* and *sarawakensis* are medium-sized, while *helsdingeni* and *brevispinus* are small. The various quantitative data for the species can be compared in table 1. The average relative eye span (ratio eye span/body length) is very uniform among the species concerned and varies only between 66% and 71%. The categories used for description of the relative eye span are given in Feijen (1998). Hardly any difference occurs in the relative eye spans of females and males, although the relative eye span is for all species marginally longer in the males. More interspecific variation occurs in the average relative length of the scutellar spines (ratio scutellar spines/body length). Large spines occur in *E. argentifera*, *sarawakensis* and *subnotata*, with ratios varying from 24% to 26%. Smaller spines occur in *E. brevispinus* and *glabrostylus* (ratios varying from 19% to 20%), while the spines are with 15% smallest in *E. helsdingeni*.

Head. – Small, rounded facial teeth occur in *E. argentifera* and *subnotata*. In the other four species the

Table 1. Measurements (in mm) and other quantitative characters for the six recognized *Eurydiopsis* species.

Character	<i>Eurydiopsis helsdingeni</i>		<i>Eurydiopsis subnotata</i> complex								
			<i>argentifera</i>		<i>brevispinus</i>		<i>glabrostylus</i>		<i>sarawakensis</i>	<i>subnotata</i>	
	♀	♂	♀	♂	♀	♂	♀	♂	♂	♀	♂
Length of body	8.2	7.8	9.7	9.3	8.5	8.6	10.7	10.2	9.4	11	9.7
Eye span	5.4	5.7	6.6	6.4	5.4	5.7	6.9	7	6.6	7.5	6.9
Ratio eye span/ body length	0.66	0.73	0.68	0.71	0.64	0.66	0.66	0.69	0.7	0.68	0.71
Length of wing	5.4	5.3	7.1	6.7	6.6	6.4	7.2	7.1	7	7.9	6.8
Length of sc. spines	1.27	-	2.31	2.26	1.71	1.71	2.01	2.05	2.46	2.73	2.41
Ratio scsp/body	0.15	-	0.24	0.24	0.2	0.2	0.19	0.2	0.26	0.25	0.25
Ratio l/w of femur 1	3.6	3.6	5.1	5.1	5.1	4.7	5.4	5.5	5.1	5.3	5.3
Outer tub. of femur 1	18.7	19	20.6	20.3	18.7	19	19.3	21.8	20.2	22.5	22.5
Inner tub. of femur 1	22.3	24	23.1	23.2	22.8	23.5	22.1	24.3	22.5	26	24.7
Ratio l/w of cerci	2.5	1.6	1.8	3.4	1.7	5	1.7	3.6	3.1	1.9	7.6
Ratio l/w of gonostyli		10		1.5-1.6		2.4-2.7		2.7	1.7		2.3
% coverage of gono- styli with microtrichia		< 5		40-50		< 5		< 5	30		30
Flies examined	3	1	8	5	2	3	5	5	3	3	9

facial corners are rounded. Small differences occur in the structural pattern and the pollinosity pattern of the frons. The IVB is minuscule in all species, except for *E. sarawakensis*, in which it is somewhat longer.

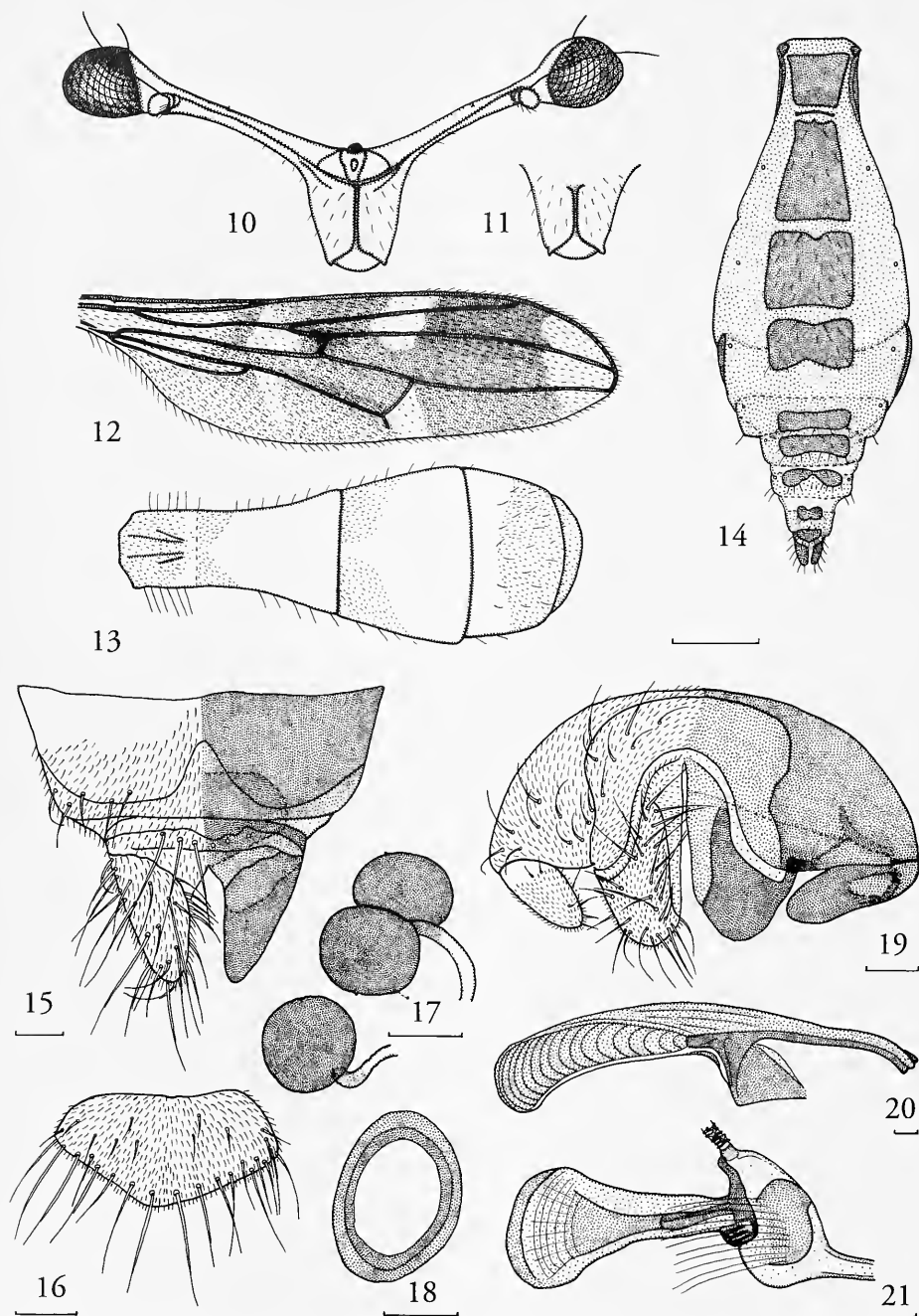
Wing. – In *E. helsdingeni* a large area of apical infuscation occurs, in *glabrostylus* a small area of infuscation occurs at the apex, while in the other four species no apical infuscation occurs at the tip. The distal anterior hyaline spot is small in *E. subnotata*, medium-sized in *helsdingeni* and large in the other four species. This spot continues well into the first posterior cell in *E. argentifera*, *brevispinus*, *glabrostylus* and *helsdingeni*, while in *sarawakensis* and *subnotata* the spot does not cross the third vein. The proximal anterior hyaline spot and the wingbase are glabrous in *E. helsdingeni*, while in the other five species the wings are almost uniformly pollinose with only in the basal region some tiny glabrous spots.

Legs. – The front femur is incrassate in *E. helsdingeni* (ratio length/width 3.6) and slightly incrassate to slender (ratios varying between 4.7 and 5.5) in the species of the *subnotata* complex. No sexual dimorphism could be found in this respect. In one species (*E. brevispinus*) the femur is even slightly more incrassate in the male, while normally in dimorphic diopsids the male has more slender femora. The categories used for description of the ratio length/width of the front femur are given in Feijen (1998). The numbers of tubercles in the two rows on the front femora cannot serve as differential characters within *Eurydiopsis* (table 1).

Preabdomen. – In *E. helsdingeni* the syntergum includes the first four terga, while in the species of the *subnotata* complex only the first three terga are included. According to Feijen (1989: 109) the only other diopsid with a syntergum consisting of terga 1+2+3+4 is *Cobiopsis latifascia* (Brunetti 1928: 592). Minor specific differences occur in the patterns of the densely white pollinose spots.

Female postabdomen. – Tergum 8 is divided into two sclerites in *E. helsdingeni* and *glabrostylus*, whereas in the other species it is a single plate, with a medial constriction in some species. Sternum 8 is strongly constricted in *E. helsdingeni*, less constricted in *argentifera* and *brevispinus* and not constricted in *glabrostylus* and *subnotata*. The cerci are rather broad in *E. helsdingeni* (ratio length/width 2.5) and broad in the other species (ratios varying from 1.7-1.9). The following categories are used for description of both female and male cerci: *broad* if the ratio length/width (L/W) is ≤ 2.0 , *rather broad* in case of $2.0 < L/W \leq 3.0$, *rather elongate* for $3.0 < L/W \leq 4.0$, *elongate* for $4.0 < L/W \leq 5.0$, and *very elongate* for $5.0 < L/W$. The subanal plate is more or less pentagonal in *E. helsdingeni*, *argentifera* and *subnotata*, triangular in *brevispinus* and somewhat rectangular with rounded posterior corners in *glabrostylus*.

Male postabdomen. – Sternum 5 is divided in *E. helsdingeni* and a single plate in the other species. The ratio length/width of the gonostyli is a major differential character and varies from 10 in *E. helsdingeni*, via 2.3-2.7 in *brevispinus*, *glabrostylus* and *subnotata*,



Figs. 10-21. *Eurydiopsis argentifera*. – 10, ♀, head in anterior view; 11, ♂, head in anterior view; 12, ♂, wing; 13, ♂, dorsal view of abdomen; 14, ♀, ventral view of abdomen; 15, dorsal view of ♀ terga 8, 10 and cerci; 16, ventral view of subanal plate; 17, spermathecae; 18, genital ring; 19, posterior view of perianthrium with gonostyli and cerci; 20, lateral view of phallopodeme; 21, ejaculatory apodeme and sac. Scales: 1 mm (10-14), 0.1 mm (15-21). – Figs. 10, 15-21, Malaysia, Malaya (bred), 13, Indonesia, Sulawesi, nr. Bantimurung.

to 1.5-1.7 in *argentifera* and *sarawakensis* (table 1). The gonostyli are slightly constricted in *E. brevispinus* and *glabrostylus*. In *E. helsdingeni*, *brevispinus* and *glabrostylus* the gonostyli are largely glabrous with only a few microtrichia apically, in *sarawakensis* and *subnotata* the apical third of the outer side is covered with microtrichia, whereas in *argentifera* almost the whole apical half is pollinose. The ratio length/width of the cerci varies from 1.6 to 7.6. However, the shape of the cerci is rather irregular, making this character less useful.

KEY TO THE SPECIES

1. Syntergum 1+2+3, base of wing pollinose, front femur moderately incrassate to slender (ratio l/w > 4.5), ♂ sternum 5 a single sclerite, ratio l/w of gonostylus < 3 (*subnotata* complex) 2
- Syntergum 1+2+3+4, base of wing glabrous, front femur incrassate (ratio l/w < 4), ♂ sternum 5 divided, ratio l/w of gonostylus ± 10, Java. *helsdingeni*
2. Small facial teeth present 3
- Facial teeth absent 4
3. Depression in front of ocellar tubercle, frons pollinose, small distal anterior wingspot not extending into first posterior cell, ♀ sternum 8 medially not constricted, ratio l/w of gonostyli ± 2.3, Philippines *subnotata*
- Elevation in front of ocellar tubercle, frons glossy, large distal anterior wingspot extending into first posterior cell, ♀ sternum 8 medially constricted, ratio l/w of gonostyli ± 1.5-1.6, Indonesia and Malaya. *argentifera*
4. Distal anterior wingspot extending into first posterior cell, rvb a minuscule wart, scutellar spines medium-sized (19-20% of body length), ratio l/w of gonostyli ± 2.4-2.7, gonostyli largely glabrous with apically a few microtrichia. 5
- Distal anterior wingspot not extending into first posterior cell, rvb a small bristle, scutellar spines large (± 26% of body length), ratio l/w of gonostyli ± 1.7, apical third of outer side of gonostyli pollinose, Borneo *sarawakensis* sp. n.
5. Wing apex slightly infuscated, ♀ tergum 8 divided, subanal plate apically rounded, gonostyli slightly constricted, ♂ cercus with ratio l/w ± 3.6, Philippines. *glabrostylus* sp. n.
- Wing apex hyaline, ♀ tergum 8 a single sclerite, subanal plate triangular, gonostyli not constricted, ♂ cercus with ratio l/w ± 5.0, Laos and Myanmar. *brevispinus* sp. n.

Eurydiopsis argentifera (Bigot, 1874) (figs. 1-3, 10-21)

Diopsis argentifera Bigot, 1874: 112. Two syntypes (as 'co-types'), Celebes (Sulawesi), Indonesia (UMO). [Examined] *Diopsis subnotata*, Walker 1861: 263 (wrong identification); Bigot 1881: 372 (senior synonym of *argentifera*, quoting Osten Sacken 1882: 237; Osten Sacken 1882: 237 (senior synonym of *argentifera*); van der Wulp 1896: 171, 1897: 192; de Meijere 1924: 60; Shillito 1971: 290-291; Tan 1965: 14, 1966: 133, 1967: 36; Burkhardt & de la Motte 1983: 99, 1985: 204.

Further material. – 1 ♀, 1 ♂, Indonesia, Sulawesi, nr. Bantimurung, Pattunuang Asue, 17-20. iv.1991, c60m, C. v. Achterberg (RMNH); 1 ♂, Indonesia, Sulawesi, Watuwila Sulawesi SW 08, 16.x.1989, Krikken & Blom (RMNH); 1 ♂, Indonesia, Java, Batoerraden, G. Slamet., 17.vii.1927, F.C. Drescher (ZMA); 1 ♀, Indonesia, Sumatra, Serapa Kur., vii.1915, Edw. Jacobson (ZMA); 1 ♂, Indonesia, Java, Blume (RMNH); 1 ♀, Indonesia, W. Java, Tjidaon, Udjong Kulon, 5.xii.1958, A.N.R. Wegner (RMNH); 2 ♀, 4 ♂, Malaya, Malaysia 1988, bred by Burkhardt & de la Motte (RMNH).

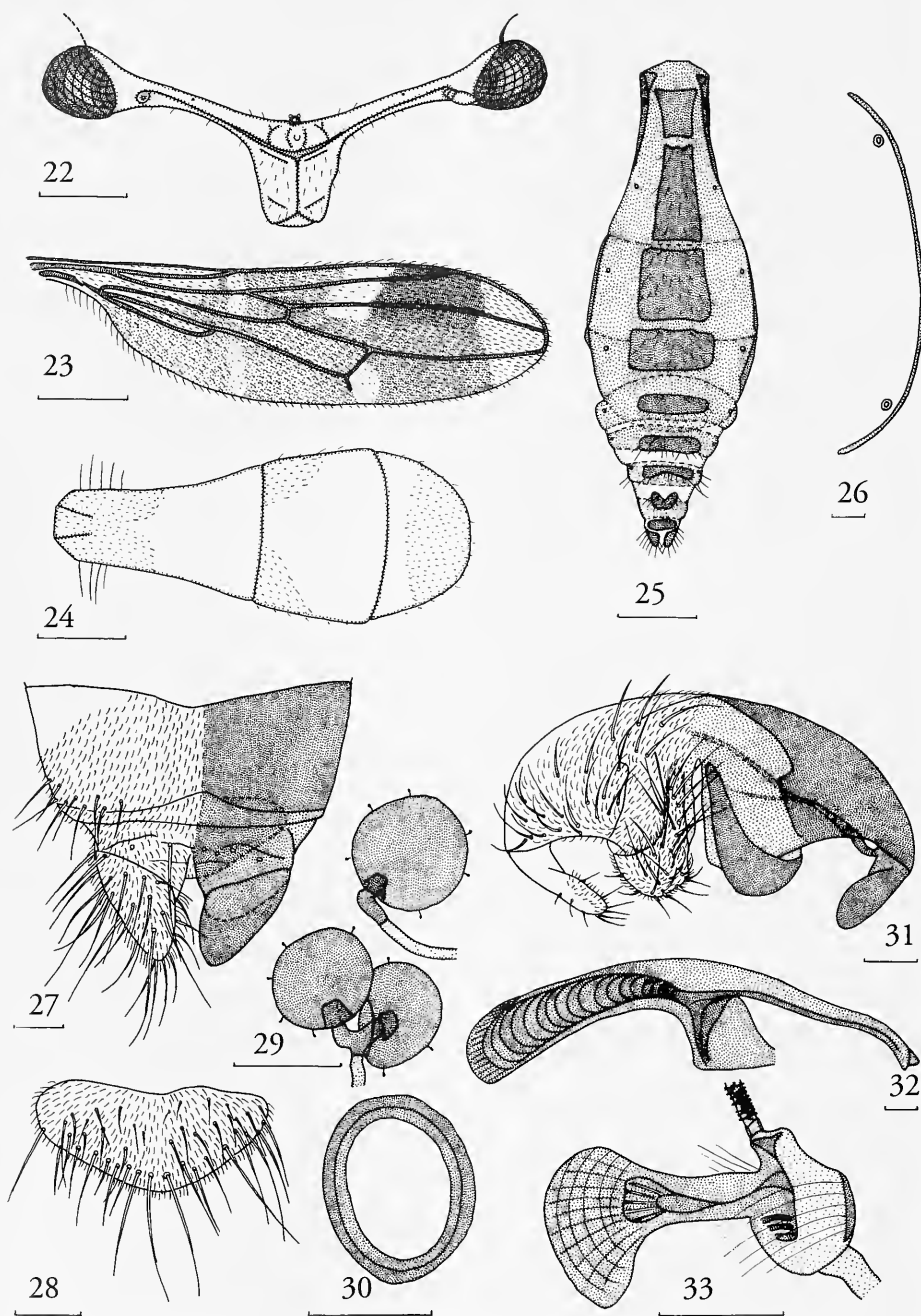
Description

Measurements. – (The measurements of the bred Malaysia flies were slightly smaller than those of wild material) Length of body in ♀ 9.7 mm ± SE 0.2 (range 9.1-10.5) and in ♂ 9.3 mm ± 0.3 (range 7.4-10.7), eye span in ♀ 6.6 mm ± 0.1 (range 6.4-7.0) and in ♂ 6.4 mm ± 0.2 (range 5.2-7.0), length of wing in ♀ 7.1 mm ± 0.1 (range 6.9-7.3) and in ♂ 6.7 mm ± 0.1 (range 6.0-7.3), length of scutellar spine in ♀ 2.31 mm ± 0.10 (range 1.83-2.57) and in ♂ 2.42 mm ± 0.06 (range 2.05-2.54).

Head. – Central part black, thinly pollinose; ocellar tubercle blackish; frons (fig. 10) with smooth elevation in front of ocellar tubercle, lateral areas smooth, a ridge around the frons; arcuate groove concolorous with rest of central part of head; face blackish, smooth and thinly pollinose, with ridge parallel to and just below arcuate groove, face somewhat bulging centrally, a few pale hairs, small blunt facial teeth present (figs. 10-11); eye span very small in female (32% smaller than the length of body) and very small in male (31% smaller than the length of body); stalks dark brown, broad apical parts blackish, pollinose; rvb tiny, ovb medium-sized, slightly longer than the diameter of the eye stalk.

Thorax. – Collar, scutum, scutellum, scutellar spines, pleura and sterna uniformly blackish brown pollinose; scutellar spines long (24% of body length), more than 3× scutellum; almost straight, slightly curved inward, diverging under an angle of 75-80°; metapleural spines large, glossy, laterally directed; very few sparse hairs on thorax.

Wing. – Apical eighth hyaline without infuscation at the tip (fig. 12); three complete transverse bands;



Figs. 22-33. *Eurydiopsis brevispinus*. – 22, ♂, head in anterior view; 23, ♂, wing; 24, ♀, dorsal view of abdomen; 25, ♀, ventral view of abdomen; 26, ♂ sternum 7+8; 27, dorsal view of terga 8, 10 and cerci; 28, ventral view of subanal plate; 29, spermathecae; 30, genital ring; 31, posterior view of perandrium with gonostyli and cerci; 32, lateral view of phallapodeme; 33, ejaculatory apodeme and sac. Scales: 1 mm (22-25), 0.1 mm (26-33). – Figs. 26, 31-33, holotype; 22, 23, ♂ paratype, Laos, Pao; 24, ♀ paratype, Laos, Pong King; 25, 27-30, ♀ paratype, Myanmar.

preapical band darkest, extending from tip of posterior crossvein to well beyond the tip of the second vein, proximal edge and apical edge straight; central band extending from base of submarginal cell to posterior crossvein, rather vague, darker around anterior crossvein; basal band very vague and irregular hardly reaching the anterior margin and constricted in anal cell, extending from base of third posterior cell to tip of anal cell; preapical band and central band broadly connected in posterior half of first posterior cell, central band and basal band connected in discal cell; except for hyaline base five hyaline spots, one from tip of costal cell extending to fourth vein, one from tip of anal cell to almost the wing margin, one large and distinct one extending from anterior wing margin to well into the first posterior cell, one basally in second posterior cell and one occupying the apical eighth of the wing; wing almost uniformly covered by microtrichia, only glabrous sections in base of costal cell and basal half of anal cell.

Legs. – Front leg brown, with blackish brown coxa, tibia and metatarsus, paler other tarsi, short black stripe apically on femur, coxa 1 pollinose, pollinosity on inner and outer side of femur 1; mid leg brown with whitish basal 2/5 of femur; hind leg brown with pale basal eighth of femur; femur 1 slender in ♀ and ♂ (ratio of length/width in both ♀ and ♂ $5.1 \pm \text{SE } 0.1$, range 4.8–5.3); tubercles on distal three-quarters, inner row in ♀ with 23.1 tubercles ± 1.1 (range 18–27) and in ♂ with 23.2 tubercles ± 1.0 (range 16–27), outer row in ♀ with 20.6 tubercles ± 1.0 (range 17–26) and in ♂ with 20.3 tubercles ± 0.8 (range 17–24).

Preabdomen. – Dorsally blackish brown, pollinose, base more whitish pollinose, terga 2 and 3 anterolaterally with whitish pollinose spots; tip (centre and apical edge of tergum 4, and tergum 5) whitish pollinose (fig. 13); syntergum consisting of terga 1, 2 and 3, seam between terga 2 and 3 distinct; sternum 1 dark brown, other sterna brown with whitish pollinose apical bands, pollinose.

Female postabdomen. – Deflexed, terga 6 and 7 rectangular plates (fig. 14: the female abdomens are in these types of figures presented in a see through way, so that the terga are visible behind the sterna); tergum 8 (fig. 15) represented by a single plate, posteriorly in a V-shaped way constricted medially, basal half of tergum 8 glabrous except medially; tergum 10 with three pair of hairs: cerci broad, ratio of length/width 1.8, covered with microtrichia and a number of hairs (fig. 15); sterna 5 and 6 single rectangular sclerites (fig. 14); sternum 7 strongly constricted medially, almost cut in two sclerites; sternum 8 a single, somewhat bean-shaped sclerite, slightly constricted medially; subanal plate (figs. 15–16) pentagonal, posteriorly nine pairs of hairs; spermathecae (fig. 17) rounded and smooth; genital ring (fig. 18) rounded.

Male postabdomen. – Terga 5 and 6 single plates; sterna 4 and 5 single rectangular sclerites; sternum 6 represented by two small sclerites; sternum 7+8 a very short, band-like sclerite; spiracles 5 and 6 in membrane, spiracle 7 located rather dorsally, anteriorly of sternum 7+8; perandrium (fig. 19) rounded, with about 17 pairs of hairs, covered with microtrichia; gonostyli rounded to rectangular in lateral view (figs. 1–3), ratio length/width 1.5–1.6, in posterior view apically rounded, apical half on outer side covered with microtrichia, on inner side glabrous, on outer side some short hairs on apical third; gonostyli interconnected via thin processus longi; cerci rather elongate, ratio length/width 3.4, broadest preapically, covered with microtrichia and hairs; phallapodeme (fig. 20) solidly built, not broadening anteriorly, anterior arm 1.5 times as long as posterior arm; ejaculatory apodeme (fig. 21) broadening anteriorly.

Diagnosis

Eurydiopsis argentifera belongs to the *subnotata* complex and can be recognized by the wing pattern (no infuscation at the tip, large distal anterior spot extending into first posterior cell), almost uniform distribution of microtrichia on the wing, tiny ivb, medium-sized ovb, presence of facial teeth, slender front femora, large scutellar spines (24% of body length), syntergum 1+2+3, posteromedially constricted female tergum 8, medially strongly constricted female sternum 7, somewhat bean-shaped female sternum 8, broad female cerci, pentagonal subanal plate, single male sternum 5, rounded to rectangular gonostyli with a ratio length/width of 1.5–1.6, distal half of outer side of gonostyli covered with microtrichia, rather elongate male cerci with a ratio length/width of 3.4 and phallapodeme with anterior arm 1.5 times as long as the posterior arm.

Eurydiopsis brevispinus sp. n.
(figs. 4–5, 22–30)

Type material. – ♂ Holotype, 1 ♀ paratype, Myanmar (Burma), Mt. Victoria, Chin hills, 1000m, iii.1938, leg. G. Heinrich (BMNH); 1 ♀ paratype, Myanmar (Burma), S. Shan States, road 40 km E. of Taunggyi, 1500m, 2–25.x.1934, Malaise (UZMH); 1 ♀ paratype, Laos, Pong King, 13.iv.1918, R. Vitalis de Salvaza (UZMH); 1 ♂ paratype, Laos, Pau, 8 km w., 18.iii.1920 (UZMH).

Description

Measurements. – Length of body in ♀ 8.5 mm $\pm \text{SE } 0.1$ (range 8.3–8.6) and in ♂ 8.6 mm (range 8.3–8.8), eye span in ♀ 5.4 mm ± 0.1 (range 5.3–5.5) and in ♂ 5.7 mm (range 5.6–5.7), length of wing in ♀ 6.6 mm ± 0.1 (range 6.5–6.8) and in ♂ 6.4 mm (range

6.1-6.6), length of scutellar spine in ♀ 1.71 mm \pm 0.05 (range 1.61-1.77) and in ♂ 1.71 mm (range 1.64-1.77).

Head. – Central part blackish, thinly pollinose, ocellar tubercle black; frons (fig. 22) somewhat variable with slight, smooth elevation in front of ocellar tubercle, slight depression below elevation, lateral areas smooth, with circular ridge around the frons; arcuate groove concolorous; face with ridge parallel to and just below arcuate groove, face somewhat bulging centrally, a few pale hairs, facial corners rounded; eye span very small in female (36% smaller than the length of body) and very small in male (34% smaller than the length of body); stalks brown, broad apical parts blackish, pollinose; *ivb* minuscule and wart-like; *ovb* medium-sized, somewhat longer than the diameter of the eye stalk.

Thorax. – Collar, scutum, scutellum, scutellar spines, pleura and sterna uniformly blackish brown pollinose; scutellar spines medium-sized (20% of body length), almost 3 \times scutellum; almost straight, slightly curved inward, diverging under an angle of more than 80°; metapleural spines large glossy, laterally directed; some hairs on thorax.

Wing. – Apical eighth hyaline without infuscation at the tip (fig. 23); three complete transverse bands, preapical band darkest and with darker anterior half, extending from tip of posterior crossvein to well beyond the tip of the second vein, proximal edge curved and apical edge straight; central band extending from base of submarginal cell to posterior crossvein, rather vague, darker around anterior crossvein; basal band very vague and irregular hardly reaching the anterior margin and constricted in anal cell, extending from base of third posterior cell to tip of anal cell; preapical band and central band broadly connected around fourth vein, central band and basal band connected around fifth vein; except for hyaline base five hyaline spots, one from tip of costal cell extending into discal cell, one from tip of anal cell to wing margin, one large and distinct one extending from anterior wing margin to well into the first posterior cell, one basally in second posterior cell and one occupying the apical eighth of the wing; wing almost uniformly covered by microtrichia, glabrous sections include most of costal cell and basal parts of second basal cell and anal cell.

Legs. – Front leg brown, with darker coxa, tibia and metatarsus, paler other tarsi, coxa densely pollinose, remainder of front leg thinly pollinose; mid leg and hind leg brown, apices of femur darker; femur 1 slender in female (ratio of length/width 5.1 \pm SE 0.1, range 4.9-5.2) and moderately incrassate in male (ratio of length/width 4.7, range 4.6-4.8); tubercles on distal two-thirds, inner row in ♀ with 22.8 tubercles \pm 0.5 (range 21-25) and in ♂ with 23.5 tubercles (range 23-24), outer row in ♀ with 18.7 tubercles \pm 0.8 (range

16-21) and in ♂ with 19.0 tubercles (range 19).

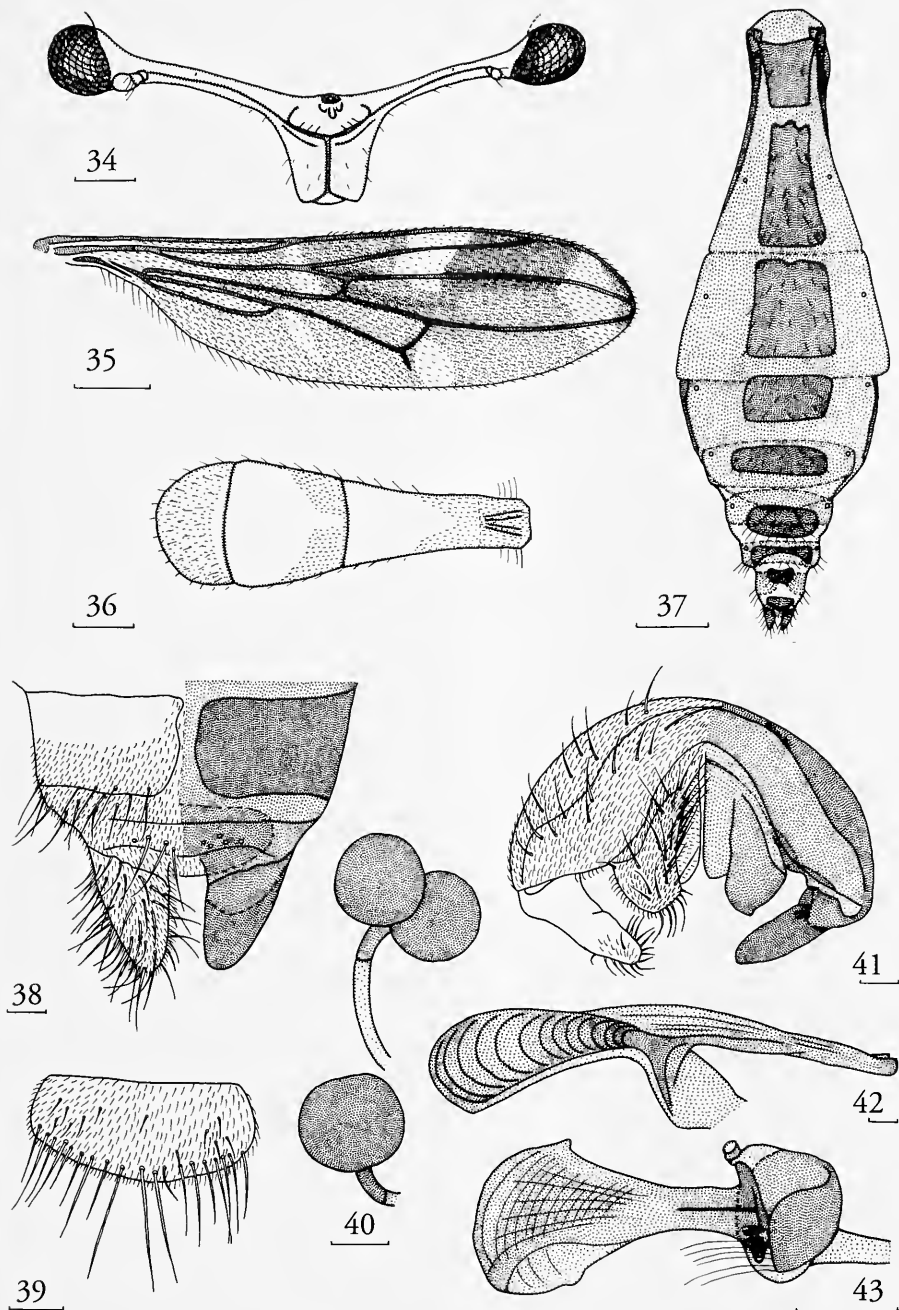
Preabdomen. – Dorsally blackish brown, pollinose, base more whitish pollinose, terga 2 and 3 anterolaterally with whitish pollinose spots; tip (centre and apical edge of tergum 4, and tergum 5) whitish pollinose (fig. 24); syntergum consisting of terga 1, 2 and 3, seam between terga 2 and 3 distinct; sternum 1 dark brown, other sterna brown with whitish pollinose apical bands, pollinose.

Female postabdomen. – Deflexed, terga 6 and 7 rectangular plates (fig. 25), tergum 8 (fig. 27) slightly constricted medially, tergum 8 covered with microtrichia except in anterolateral corners; tergum 10 with three pair of hairs: cerci broad, ratio of length/width 1.7, covered with microtrichia and a number of hairs (fig. 27); sterna 5 and 6 single rectangular sclerites (fig. 25); sternum 7 also rectangular but concave posteriorly; sternum 8 a single V-shaped sclerite; spiracle 7 in membrane; subanal plate (figs. 27-28) triangular to kidney-shaped, posteriorly nine pairs of hairs; spermathecae (fig. 29) rounded and smooth; genital ring (fig. 30) rounded.

Male postabdomen. – Terga 5 and 6 single plates; sterna 4 and 5 single rectangular sclerites; sternum 6 represented by two small triangular sclerites; sternum 7+8 a very short, band-like sclerite (fig. 26); spiracles 5 and 6 in membrane, spiracle 7 located rather dorsally, anteriorly of sternum 7+8 (fig. 26); perianthrium (fig. 31) rounded, with about 23 pairs of relatively long hairs, covered with microtrichia; gonostyli oblong in lateral view with rounded apical corners (figs. 4-5), ratio length/width 2.4-2.7, very slightly constricted in the middle, in posterior view apically rounded, only the very apex on inner and outer side with a few microtrichia, on outer side relatively long hairs on apical half; gonostyli interconnected via thin processus longi; cerci elongate, ratio length/width 5.0, broadest preapically, covered with microtrichia and hairs; phallapodeme (fig. 32) rather slender, not broadening anteriorly, anterior arm slightly longer than posterior arm; ejaculatory apodeme (fig. 33) broadening anteriorly.

Diagnosis

Eurydiopsis brevispinus belongs to the *subnotata* complex and can be recognized by its wing pattern (no infuscation at the tip, large distal anterior spot extending into first posterior cell), almost uniform distribution of microtrichia on the wing, minuscule *ivb*, medium-sized *ovb*, absence of facial teeth, moderately incrassate to slender front femora, medium-sized scutellar spines (20% of body-length), syntergum 1+2+3, rectangular (medially slightly constricted) female tergum 8, almost rectangular sternum 7, V-shaped female sternum 8, broad female cerci, triangular subanal plate, single male sternum 5, oblong gonostyli with a ratio length/width



Figs. 34-43. *Eurydiopsis glabrostylus*. – 34, ♀ head in anterior view; 35, ♀ wing; 36, ♂ dorsal view of abdomen; 37, ♀ ventral view of abdomen; 38, dorsal view of ♀ terga 8, 10 and cerci; 39, ventral view of subanal plate; 40, spermathecae; 41, posterior view of perianthrium with gonostyli and cerci; 42, lateral view of phallapodeme; 43, ejaculatory apodeme and sac. Scales: 1 mm (34-37), 0.1 mm (38-43). – All paratypes, Philippines, Aroroy.

of 2.4-2.7, glabrous gonostyli with only apically a few microtrichia, elongate male cerci with a ratio length/width of 5.0 and phallapodeme with anterior arm only slightly longer than posterior arm.

Eurydiopsis glabrostylus sp. n.
(figs. 6, 34-43)

Type material. — ♂ holotype, 1 ♂ paratype, Philippines, Masbate, Aroroy, x.1917 (UZMH); 1 ♀ paratype, Philippines, Masbate, Aroroy, viii.1918 (UZMH); 1 ♀ paratype, 1 ♂ paratype, Philippines, Luzon, Los Banos, iv.1914 (UZMH); 2 ♀ paratypes, 1 ♂ paratype, Philippines, Polillo, 18.viii.1915 (UZMH); 1 ♀ paratype, 1 ♂ paratype, Philippines, Mindoro, Subaan, i.1916 (UZMH).

Description

Measurements. — Length of body in ♀ 10.7 mm ± SE 0.6 (range 8.5-12.4) and in ♂ 10.2 mm ± 0.4 (range 8.8-11.2), eye span in ♀ 6.9 mm ± 0.4 (range 5.5-8.1) and in ♂ 7.0 mm ± 0.3 (range 5.7-7.4), length of wing in ♀ 7.2 mm ± 0.4 (range 6.0-8.3) and in ♂ 7.1 mm ± 0.3 (range 6.1-7.5), length of scutellar spine in ♀ 2.01 mm ± 0.08 (range 1.74-2.23) and in ♂ 2.05 mm ± 0.05 (range 1.86-2.14).

Head. — Central part blackish brown, pollinose; ocellar tubercle blackish; frons (fig. 34) with smooth elevation in front of ocellar tubercle, lateral areas smooth, or provided with vague radiating grooves laterally and anteriorly, a vague circular ridge around the frons; arcuate groove concolorous with rest of central part of head; face with ridge parallel to and just below arcuate groove, face somewhat bulging centrally, a few pale hairs, facial corners angular, but no distinct facial teeth; eye span very small in female (34% smaller than the length of body) and very small in male (31% smaller than the length of body); stalks dark brown, broad apical parts blackish, pollinose; *rvb* a minuscule wart, *ovb* small, 1.5× the diameter of the eye stalk.

Thorax. — Collar, scutum, scutellum, scutellar spines, pleura and sterna uniformly blackish brown pollinose; scutellar spines medium-sized (19% of body length), about 3× scutellum; slightly curved inward, diverging under an angle of 75°; metapleural spines large glossy, laterally directed; some hairs on thorax.

Wing. — Apical tenth hyaline with some distinct infuscation at the tip (fig. 35); three complete transverse bands, preapical band darkest, extending from tip of posterior crossvein to well beyond the tip of the second vein, convex on proximal edge and convex on apical edge; central band extending from base of submarginal cell to posterior crossvein, rather vague, darker around anterior crossvein and in first posterior

cell; basal band very vague and irregular hardly reaching the anterior margin, extending from base of third posterior cell to tip of anal cell; preapical band and central band broadly connected around fourth vein, central band and basal band connected in and around discal cell; except for hyaline base five hyaline spots, one from tip of costal cell extending to fourth vein, one from tip of anal cell to almost the wing margin, one large and distinct one extending from anterior wing margin to well into the first posterior cell, one basally in second posterior cell and one occupying most of the apical tenth of the wing; wing almost uniformly covered by microtrichia, only a tiny glabrous section in base of costal cell.

Legs. — Front leg brown with blackish brown tibia, coxa and metatarsus, paler other tarsi, densely pollinose coxa and thinly pollinose femur; mid leg and hind leg brown with darker apical sections on femora and slightly darker tibiae; femur 1 slender in ♀ (ratio of length/width $5.4 \pm SE 0.1$, range 5.0-5.6) and slender in ♂ (ratio of length/width 5.5 ± 0.1 , range 5.2-5.8); tubercles on distal three-quarters, inner row in ♀ with 22.1 tubercles ± 0.9 (range 19-26) and in ♂ with 24.3 tubercles ± 0.8 (range 22-27), outer row in ♀ with 19.3 tubercles ± 0.6 (range 16-22) and in ♂ with 21.8 tubercles ± 1.0 (range 17-24).

Praeabdomen. — Dorsally blackish brown, pollinose, base more whitish pollinose, terga 2 and 3 anterolaterally with whitish pollinose spots; tip (including most of tergum 4 and all of tergum 5) also whitish pollinose (fig. 36); syntergum consisting of terga 1, 2 and 3, seam between terga 2 and 3 distinct; sternum 1 dark brown, other sterna brown with whitish pollinose apical bands, pollinose.

Female postabdomen. — Deflexed, terga 6 and 7 rectangular plates (fig. 37); tergum 8 (fig. 38) represented by two rectangular plates, separated medially, basal half of tergum 8 glabrous except medially; tergum 10 with four pairs of hairs, cerci broad, ratio of length/width 1.7, covered with microtrichia and a number of hairs (fig. 38); sterna 5 and 6 single rectangular sclerites (fig. 37); sternum 7 angular anteriorly and strongly concave posteriorly; sternum 8 a single, somewhat bean-shaped sclerite; subanal plate (figs. 38-39) somewhat rectangular with rounded posterior corners, posteriorly nine pairs of hairs; spermathecae (fig. 40) rounded and smooth.

Male postabdomen. — Terga 5 and 6 single plates; sterna 4 and 5 single rectangular sclerites; sternum 6 represented by two small sclerites; sternum 7+8 a very short, band-like sclerite; spiracles 5 and 6 in membrane, spiracle 7 located rather dorsally, anteriorly of sternum 7+8; perianthrium (fig. 41) rounded, with about 16 pairs of hairs, covered with microtrichia; gonostyli oblong in lateral view (fig. 6), slightly but distinctly constricted in the middle and with rounded

apical corners, ratio length/width 2.7, in posterior view apically pointed, distally on outer side a few microtrichia, on inner side glabrous, on outer side some short hairs on apical half; gonostyli interconnected via thin processus longi; cerci rather elongate, ratio length/width 3.6, broadest preapically, covered with microtrichia and hairs; phallapodeme (fig. 42) solidly built, broadening anteriorly, anterior arm just as long as posterior arm; ejaculatory apodeme (fig. 43) broadening anteriorly.

Diagnosis

Eurydiopsis glabrostylus belongs to the *subnotata* complex and can be recognized by its wing pattern (some infuscation at the tip, large distal anterior hyaline spot extending into first posterior cell), almost uniform distribution of microtrichia on the wing, minuscule *rvb*, small *ovb*, absence of facial teeth, slender front femora, medium-sized scutellar spines (19% of body length), syntergum 1+2+3, divided female tergum 8, posteriorly strongly concave female sternum 7, bean-shaped female sternum 8, broad female cerci, rectangular subanal plate with rounded posterior corners, single male sternum 5, oblong gonostyli slightly constricted in the middle and with a ratio length/width of 2.7, glabrous gonostyli with only apically a few microtrichia, male cerci with a ratio length/width of 3.6 and phallapodeme with equal-sized arms.

Eurydiopsis helsdingeni sp. n.
(figs. 7, 44-55)

Diopsis circularis, van der Wulp, 1897: 189 (nec *circularis* Macquart).

Diopsis circularis, Frey, 1928: 70 (nec *circularis* Macquart).

Type material. – ♀ Holotype, Indonesia, Java, Blume, Coll. F.M. v. d. Wulp (RMNH); 1 ♀, 1 ♂ paratype, Indonesia, Java, Fruhstorfer (IRSNB); 1 ♀ paratype, Indonesia, Java, Batavia (= Djakarta), von Röder (MLUH). The first three specimens were identified by van der Wulp (1897) as '*Diopsis circularis*'. The second specimen was also by E. Brunetti identified as '*D. circularis*'.

Etymology. – It is my pleasure to name this interesting species after Dr. P. J. van Helsdingen, curator of Diptera at the Leiden Museum. Dr. van Helsdingen originates from the same island as *Eurydiopsis helsdingeni* sp. n.

Description

Measurements. – Length of body in ♀ 8.2 mm (range 7.8-8.6) and in ♂ 7.8 mm, eye span in ♀ 5.4 mm (range 5.2-5.7) and in ♂ 5.7 mm, length of wing in ♀ 5.4 mm (range 5.2-5.7) and in ♂ 5.4 mm,

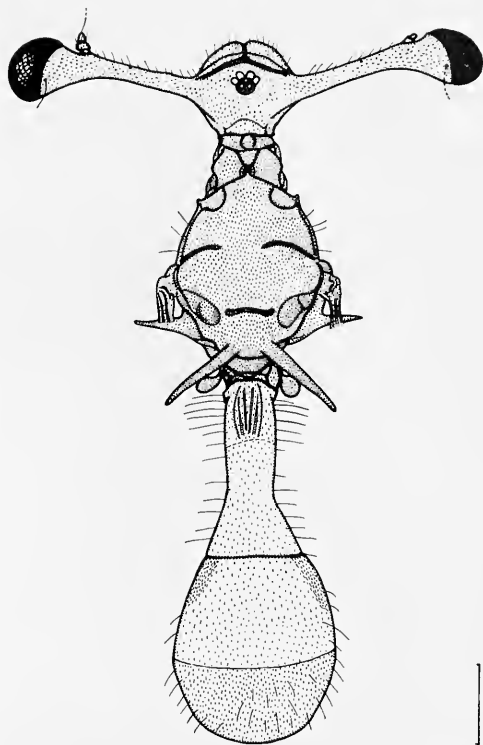
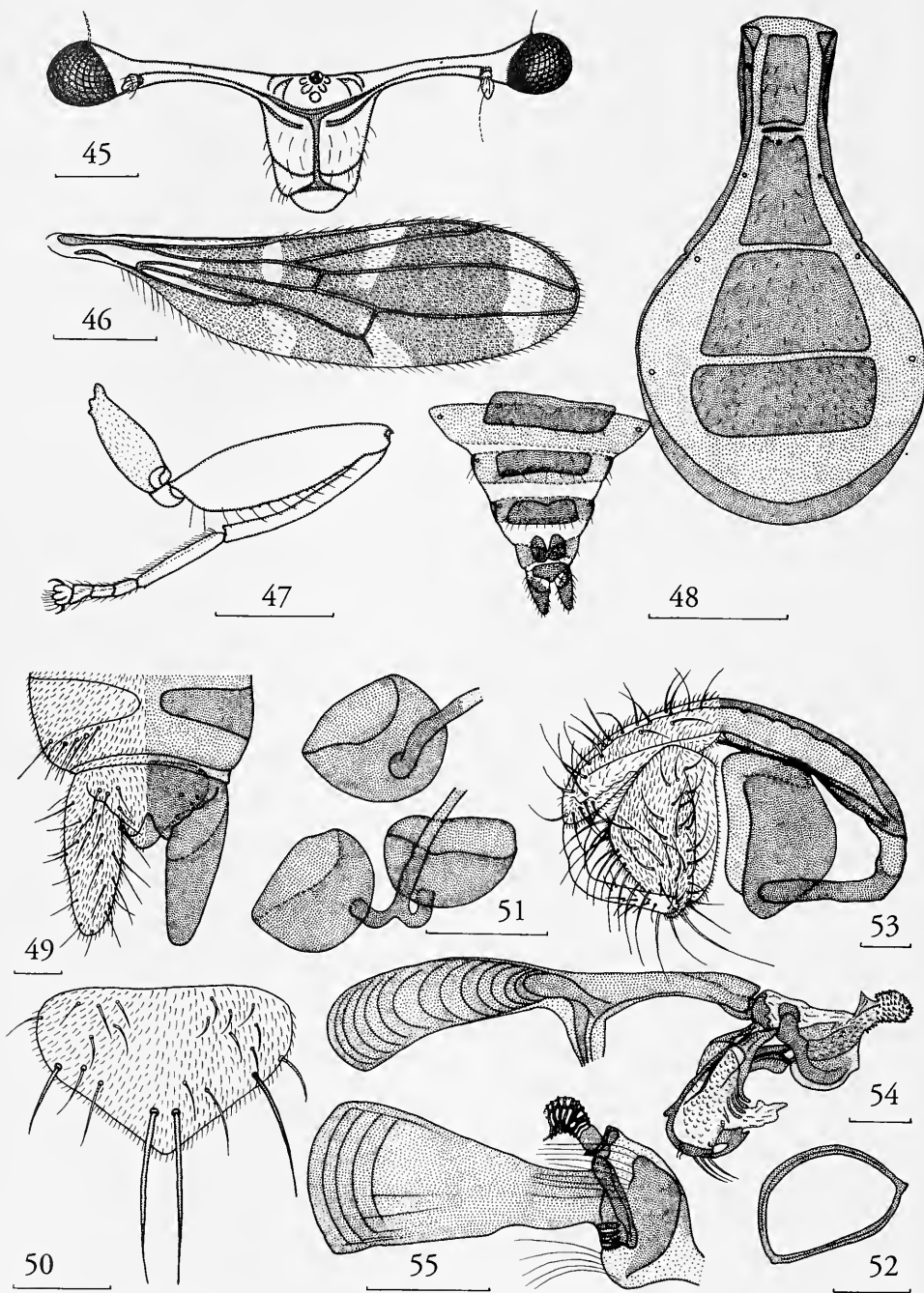


Fig. 44. *Eurydiopsis helsdingeni*. – ♀ paratype, Indonesia, Java, habitus in dorsal view. Scale: 1 mm.

length of scutellar spine in ♀ 1.27 mm (range 1.24-1.30), scutellar spines broken in ♂.

Head. – Central part uniformly brown (not black as stated by van der Wulp 1897), thinly pollinose; frons (figs. 44-45) with small rounded elevation in front of ocellar tubercle, anteriorly and laterally of ocellar tubercle some small depressions, lateral areas smooth, a ridge around the frons; arcuate groove dark brown; face with ridge parallel to and just below arcuate groove, smooth, lower fifth somewhat depressed, a few pale hairs, facial corners rounded, definitely without very small facial teeth as stated by van der Wulp 1897; eye span very small in female (34% smaller than the length of body) and very small in male (27% smaller than the length of body); stalks brown, broad apical parts blackish, pollinose, funiculus pale brown; *rvb* just indicated as a minuscule black wart (not absent as mentioned by van der Wulp); *ovb* medium-sized, 1.5× the diameter of the stalk.

Thorax. – Collar dark brown to blackish brown, pollinose; scutum, scutellum and scutellar spines concolorous with collar, pollinose; pleura and sterna also



Figs. 45-55. *Eurydiopsis helsdingeni*. – 45, ♀, head in anterior view; 46, ♀, wing; 47, ♀, front leg, outer side; 48, ♀ ventral view of abdomen; 49, dorsal view of ♀ terga 8, 10 and cerci; 50, ventral view of subanal plate; 51, spermathecae; 52, genital ring; 53, posterior view of perianthrium with gonostyli and cerci; 54, lateral view of phallapodeme and aedeagus; 55, ejaculatory apodeme and sac. Scales: 1 mm (45-48), 0.1 mm (49-55). – Figs. 48-52, holotype, Indonesia, Java; 45, 53-55, paratypes, Indonesia, Java; 46, 47, ♀ paratype, Indonesia, Java, Batavia.

concolorous and uniformly pollinose; scutellar spines (fig. 44) relatively small (15% of body length), almost $2.5\times$ scutellum, pointed slightly upward, tip curving slightly inward, diverging under an angle of 90° ; metapleural spines rather large, laterally directed; a sparse distribution of fine hairs on thorax, especially on the scutellar spines.

Wing. – Apex with large patch of infuscation (fig. 46); three complete transverse dark bands, the bands together with the infuscated apex giving van der Wulp's 'vier bruine dwarsbanden' (four brown crossbands); preapical band darkest and broadest, extending from tip of posterior crossvein to apically of tip of second vein; central band extending from base of submarginal cell to tip of fifth vein; basal band vague and irregular, hardly reaching the anterior margin and constricted in anal cell, extending from base of third posterior cell to apex of anal cell; basal and central band connected around fifth vein, central band and subapical band connected around fourth vein; except for hyaline base five hyaline spots, one from tip of costal cell extending to just in discal cell, one centrally in third posterior cell, one extending from subapically in the marginal cell to halfway in the first posterior cell, one basally in second posterior cell just extending in discal cell and one hyaline subapical crossband between dark subapical band and infuscated tip; the glabrous basal wing parts include most of the subcostal cell, basal tip of marginal cell, basal half of first basal cell, basal tip of second basal cell and most of anal cell, the hyaline spot below the tip of the subcostal cell is also glabrous. Van der Wulp indicated the differences with the wing pattern of Macquart's *circularis*, but thought these due to inaccuracies and 'phantasie' of Macquart (1835). However, Macquart's inaccuracy consisted only of mentioning Java as a location of the African *circularis*. Macquart made exactly the same error with his *subfasciata* (see Feijen 1978).

Legs. – Front leg brown, coxa, tibia and metatarsus dark brown, thinly pollinose; mid leg and hind leg brown with darker tibiae, pollinose; femur 1 (fig. 47) incrassate in ♀ (ratio of length/width 3.5, range 3.4–3.5) and incrassate in ♂ (ratio of length/width 3.6); tubercles on distal three-quarters, inner row in ♀ with 22.3 tubercles (range 22–23) and in ♂ with 24 tubercles, outer row in ♀ with 18.7 tubercles (range 18–19) and in ♂ with 19 tubercles, outer row without gap.

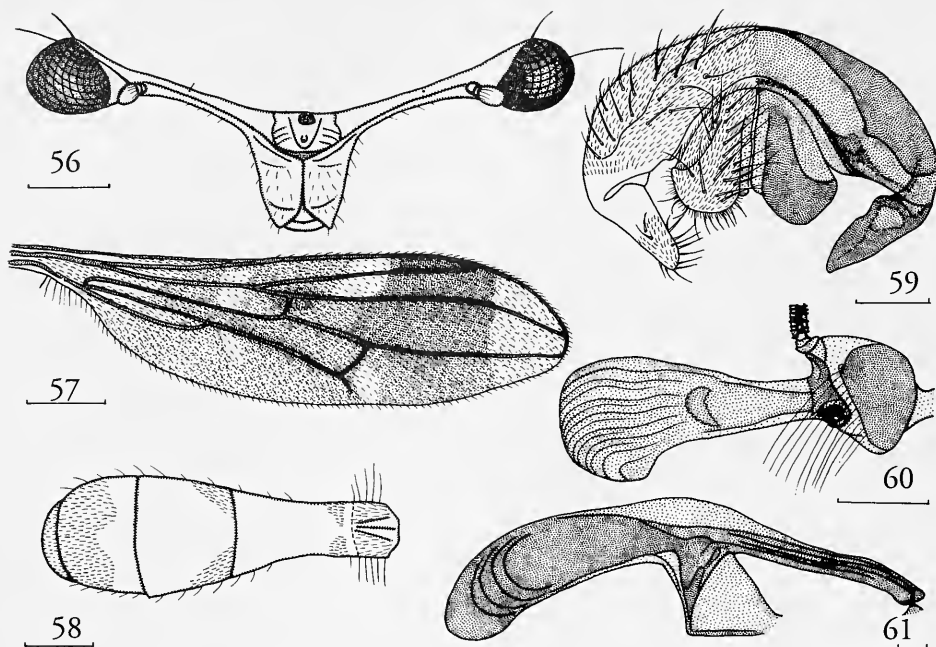
Preabdomen. – Dorsally dark brown, uniformly pollinose, tergum 3 (fig. 44) anterolaterally with densely pollinose spots; basally strongly constricted, posteriorly (tergum 4) rounded; syntergum consisting of the terga 1, 2, 3 and 4, seam between terga 2 and 3 distinct, seam between terga 3 and 4 less distinct; sterna pale brown, sternum 1 darker; spiracle 1 in tergum (fig. 48) other spiracles in membrane.

Female postabdomen. – Strongly deflexed under syntergum 1–4 (figs. 44, 48); terga 6 and 7 rectangular plates (fig. 48); tergum 8 (fig. 49) represented by two sclerites narrowly separated medially, sclerites covered by microtrichia; tergum 10 with four pairs of hairs, no long central hairs; cerci rather broad, ratio of length/width 2.5, covered with microtrichia and a number of hairs (fig. 49); sterna 5, 6 and 7 single rectangular sclerites (fig. 48), sternum 6 more sclerotized posteriorly; sternum 8 strongly constricted medially, the two halves narrowly connected posteriorly; spiracle 7 in membrane; subanal plate (figs. 49–50) almost triangular with rounded lateral corners, posteriorly two pairs of long hairs and two pairs of short hairs, the central pair of long hairs quite pronounced; spermathecae (fig. 51) rounded, apically concave but this may be due to an artefact, smooth; genital ring rounded (fig. 52).

Male postabdomen. – Terga 5 and 6 rectangular sclerites; sternum 4 a single rectangular sclerite; sternum 5 represented by a pair of L-shaped sclerites; sternum 6 represented by a pair of tiny sclerites; sternum 7+8 a short, band-like sclerite; spiracle 5 in membrane, spiracle 6 just in membrane, spiracle 7 located rather dorsally, anteriorly of sternum 7+8; perianthrium (fig. 53) rounded, with about 22 pairs of hairs, covered with microtrichia; gonostyli (fig. 7) long and slender, ratio length/width about 10, glabrous with apically some hairs and microtrichia, fused to perianthrium but on cursory inspection apparently articulate; gonostyli via thin processus longi connected to posterior edge of perianthrium and from there interconnected via thin processus; cerci broad, ratio of length/width 1.6, covered with microtrichia and hairs, apically some long hairs; phallapodeme (fig. 54) rather slender, anterior arm slightly broadening anteriorly and one third longer than posterior arm; ejaculatory apodeme small, wedge-shaped (fig. 55).

Diagnosis

Eurydiopsis helsdingeni takes up an isolated position in its genus, all other known species belonging to the *subnotata* complex. It can be recognized by its wing pattern (three dark crossbands and infuscated apex, five hyaline spots), distribution of microtrichia on the wing (glabrous base and glabrous basal anterior spot), minuscule ivb, medium-sized ovb, absence of facial teeth, incrassate front femora, small scutellar spines (15% of body length), syntergum 1+2+3+4 with distinct seam between 2 and 3 and less distinct seam between 3 and 4, divided female tergum 8, rectangular female sternum 7, triangular subanal plate, rather broad female cerci, divided male sternum 5, long, slender and almost glabrous gonostyli with ratio length/width of 10, broad male cerci and phallapodeme with anterior arm one third longer than posterior arm.



Figs. 56-61. *Eurydiopsis sarawakensis*, male. – 56, head in anterior view; 57, wing; 58, dorsal view of abdomen; 59, posterior view of perianthrium with gonostyli and cerci; 60, ejaculatory apodeme and sac; 61, lateral view of phallapodeme. Scales: 1 mm (56-58), 0.1 mm (59-61). – Figs. 56, 58 holotype, 57 and 59-61, paratype, Malaysia, Sabah, Tenompok.

Eurydiopsis sarawakensis sp. n.
(figs. 8, 56-61)

Type material. – ♂ Holotype, Malaysia, Sarawak, Batu Niah, 29.xi.-27.xii.1980, A. Harman (RMNH); 1 ♂, Malaysia, Sabah (N. Borneo) or Sarawak: 1958-1959, T.C. Maa (BPBM); 1 ♂, Malaysia, Sabah (British Borneo), Tenompok, 1460m, Jesselton 30 mi. E., 10-19.ii.1959, T.C. Maa (BPBM).

Description

Measurements. – Length of body in ♂ $9.4 \text{ mm} \pm \text{SE } 0.3$ (range 8.8-9.9), eye span in ♂ $6.6 \text{ mm} \pm 0.1$ (range 6.5-6.8), length of wing in ♂ $7.0 \text{ mm} \pm 0.1$ (range 6.8-7.2), length of scutellar spine in ♂ $2.46 \text{ mm} \pm 0.07$ (range 2.33-2.54).

Head. – Central part dark brown, pollinose; ocellar tubercle blackish; frons (fig. 56) with elevation in front of ocellar tubercle and with small circular depression in front of elevation, surrounded by V-shaped depression, lateral areas almost smooth, with some very vague grooves, a circular groove around the frons; arcuate groove concolorous with central section of head; face with ridge parallel to and just below arcuate groove, face somewhat bulging centrally, a few pale hairs, facial corners angular but without distinct facial

teeth; eye span very small in male (30% smaller than the length of body); stalks brown, broad apical parts blackish, pollinose; ivb small, not more than half the length of the diameter of the eye stalk; ovb medium-sized, somewhat longer than the diameter of the stalk.

Thorax. – Collar, scutum, scutellum, scutellar spines, pleura and sterna uniformly blackish brown pollinose; scutellar spines long (26% of body length), $3.5 \times$ scutellum; almost straight, very slightly curved inward diverging under an angle of 75° ; metapleural spines large glossy, laterally directed; some hairs on thorax.

Wing. – Apical eighth almost hyaline without infuscation at the tip (fig. 57); three complete transverse bands: preapical band darkest, extending from tip of posterior crossvein to well beyond the tip of the second vein, proximal edge slightly convex and apical edge straight; central band extending from just before base of submarginal cell to just past posterior crossvein, rather vague, darker around anterior crossvein and around fifth vein; basal band very vague and irregular hardly reaching the anterior margin and constricted in anal cell, extending from base of third posterior cell to tip of anal cell; preapical band and central band broadly connected in whole of first posterior cell and in anterior part of second posterior cell,

central band and basal band connected in whole of discal cell; except for hyaline base five hyaline spots, one just not reaching tip of costal cell and extending to fourth vein, one from tip of anal cell to halfway the wing margin, one distinct one extending from anterior wing margin to third vein, one basally in second posterior cell near wing margin and one occupying the apical eighth of the wing; wing almost uniformly covered by microtrichia, glabrous sections include basal half of costal cell and basal parts of second basal cell and anal cell.

Legs. – Front leg brown, blackish brown tibia, coxa and metatarsus, paler other tarsi; coxa densely pollinose, remainder of leg thinly pollinose, with more dense pollinosity on sides of femur, mid leg and hind leg brown with darker apical half on femur 2, two dark bands on femur 3 and darker tibiae; femur 1 slender in male (ratio of length/width 5.1, range 5.0–5.2); tubercles on distal two-thirds, inner row in ♂ with 22.5 tubercles \pm SE 0.8 (range 19–24), outer row in ♂ with 20.2 tubercles \pm 0.9 (range 18–23).

Preabdomen. – Dorsally blackish brown, pollinose, base more whitish pollinose, terga 2 and 3 anterolaterally with whitish pollinose spots; tip (centre and apical edge of tergum 4, and tergum 5) whitish pollinose (fig. 58); syntergum consisting of terga 1, 2 and 3, seam between terga 2 and 3 distinct; sternum 1 dark brown, other sterna brown with whitish pollinose apical bands, pollinose.

Male postabdomen. – Terga 5 and 6 single plates; sterna 4 and 5 single rectangular sclerites; sternum 6 represented by two small kidney-shaped sclerites; sternum 7+8 a very short, band-like sclerite; spiracles 5 and 6 in membrane, spiracle 7 located rather dorsally, anteriorly of sternum 7+8; perianthrium (fig. 59) rounded, with about 20 pairs of hairs, covered with microtrichia; gonostyli rectangular in lateral view with rounded apical corners, slightly constricted in the middle (fig. 6), ratio length/width 1.7, in posterior view apically pointed, on outer side the apical half covered with microtrichia, inner side glabrous, on outer side some hairs on apical half; gonostyli interconnected via thin processus longi; cerci rather elongate, ratio length/width 3.1, broadest preapically, covered with microtrichia and hairs; phallapodeme (fig. 61) rather slender, not broadening anteriorly, anterior arm curving downward anteriorly and slightly longer than posterior arm; ejaculatory apodeme (fig. 60) broadening anteriorly.

Diagnosis

Eurydiopsis sarawakensis belongs to the *subnotata* complex and can be recognized by its wing pattern (no infuscation at the tip, large distal anterior spot not extending into first posterior cell), almost uniform distribution of microtrichia on the wing, small

rvb, medium-sized ovb, absence of facial teeth, slender front femora, large scutellar spines (26% of body length), syntergum 1+2+3, rectangular and in the middle somewhat constricted gonostyli with a ratio length/width of 1.7, rather elongate male cerci with a ratio length/width of 3.1 and phallapodeme with anterior arm slightly longer than posterior arm.

Eurydiopsis subnotata (Westwood, 1848)

(figs. 9, 62–72)

Diopsis subnotata Westwood, 1848: 37, pl 18, fig 2. Type (♀) in BMNH, carrying a label 'identified as the type by E. E. Austen, from Philippine Is. Purchd fr. Mr. Wood 45.49'. [Examined]

Diopsis (Eurydiopsis) subnotata: Frey 1928: 71 (in part, the remainder being *glabrostylus* sp. n.).

Eurydiopsis subnotata: Steyskal 1972: 11 (in part); Steyskal 1975: 33 (in part); Feijen 1989: 62.

nec *Diopsis argentiifera* Bigot, 1874: 112.

nec '*Diopsis subnotata*': van der Wulp 1896: 171, 1897: 192; de Meijere 1924: 60, Tan 1965: 14, 1966: 133, 1967: 36; Burkhardt & de la Motte 1983: 99, 1985: 204.

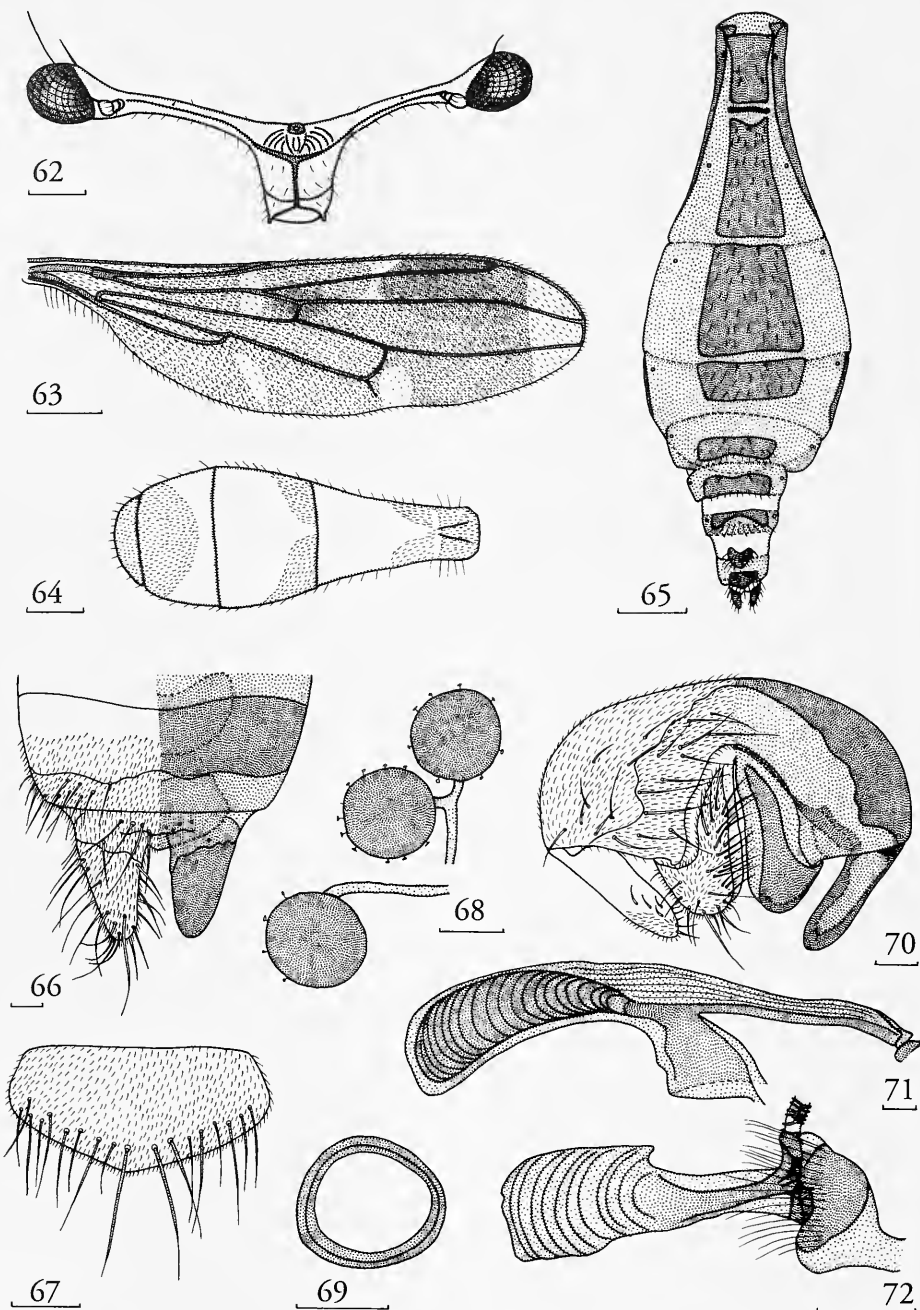
Further material. – 1 ♀, Philippines, Sororro, 17.v.1916 (UZMH); 1 ♀, Philippines, Samar, Cabalogan, iv.1915 (UZMH); 2 ♀, Philippines, Mindanao, Surigao, xi.1915 (BMNH – Received from Dr. R. Frey -, one with label '*Diopsis subnotata* Westw. Det. 1968, J.A. Tenorio'); 2 ♀, 2 ♂, Philippines, Surigao, viii.1914 (UZMH); 1 ♀, 1 ♂, Philippines, Mindanao, Surigao, xi.1915 (UZMH); 1 ♀, Philippines, Surigao, viii.1916 (UZMH).

Description

Measurements. – Length of body in ♀ 11.0 mm \pm SE 0.2 (range 10.1–11.8) and in ♂ 9.7 mm \pm 0.5 (range 8.8–10.5), eye span in ♀ 7.5 mm \pm 0.1 (range 7.3–7.7) and in ♂ 6.9 mm \pm 0.4 (range 6.1–7.4), length of wing in ♀ 7.9 mm \pm 0.1 (range 7.4–8.2) and in ♂ 6.8 mm \pm 0.3 (range 6.2–7.3) length of scutellar spine in ♀ 2.73 mm \pm 0.06 (range 2.39–2.98) and in ♂ 2.41 mm \pm 0.05 (range 2.05–2.60).

Head. – Central part dark brown, pollinose; ocellar tubercle blackish; frons (fig. 62) with ocellar tubercle on elevation surrounded by sutures, small depression in front of ocellar tubercle, lateral areas smooth or provided with vague radiating grooves laterally and a vague ridge around the frons; arcuate groove concolorous with rest of central part of head; face with ridge parallel to just below arcuate groove, face somewhat bulging centrally, a few pale hairs, facial corners with distinct small facial teeth: eye span very small in female (32% smaller than the length of body) and very small in male (29% smaller than the length of body); stalks brown, broad apical parts blackish, pollinose; funiculus paler brown, rvb minuscule; ovb medium-sized, slightly longer than the diameter of the stalk.

Thorax. – Collar, scutum, scutellum, scutellar spines, pleura and sterna uniformly blackish brown



Figs. 62-72. *Eurydiopsis subnotata*. – 62, ♀, head in anterior view; 63, ♀, wing; 64, ♀, dorsal view of abdomen; 65, ♀, ventral view of abdomen; 66, dorsal view of ♀ terga 8, 10 and cerci; 67, ventral view of subanal plate; 68, spermathecae; 69, genital ring; 70, posterior view of perianthrium with gonostyli and cerci; 71, lateral view of phallapodeme; 72, ejaculatory apodeme and sac. Scales: 1 mm (62-65), 0.1 mm (66-72). – Figs. 62, 63, 65-72, Philippines, Mindanao, Surigao; 64, Philippines, Sororro.

pollinose, scutellar spines long (25% of body length), $3.5\times$ scutellum; almost straight, slightly curved inward, diverging under an angle of 75° ; metapleural spines large, glossy, laterally directed; few sparse hairs on thorax.

Wing. – Apex hyaline with hardly any infuscation (fig. 63) at the tip; three complete transverse bands, preapical band darkest (especially anteriorly) and slightly broader than central band, extending from tip of posterior crossvein to well beyond the tip of the second vein, apical edge of preapical band straight; central band extending from base of submarginal cell to posterior crossvein, rather vague, darker around anterior crossvein; basal band very vague and irregular, hardly reaching the anterior margin and constricted in the anal cell, extending from base of third posterior cell to tip of anal cell; preapical band and central band broadly connected in whole of first posterior cell and anterior part of second posterior cell, central band and basal band connected in whole of discal cell; except for hyaline base five hyaline spots, one from tip of costal cell extending to fourth vein, one from tip of anal cell to wing margin, one narrow one extending from anterior margin to third vein at the level of posterior crossvein, one basally in second posterior cell and one occupying the apical tenth of the wing; wing almost uniformly covered by microtrichia, only a tiny glabrous section in base of costal cell.

Legs. – Front leg brown with blackish brown coxa, tibia and metatarsus, paler other tarsi, pollinose anteriorly and basally on coxa 1 and on inner side of femur; mid leg brown with whitish basal two-fifth of femur and dark apex of femur; hind leg brown with basal eighth of femur whitish; femur 1 slender in ♀ (ratio of length/width 5.3, range 5.0–5.7) and slender in ♂ (ratio of length/width $5.3 \pm \text{SE } 0.1$, range 5.2–5.4); tubercles on distal three-quarters, inner row in ♀ with $29.0 \text{ tubercles} \pm 0.8$ (range 22–29) and in ♂ with $24.7 \text{ tubercles} \pm 1.8$ (range 19–29), outer row in ♀ with $22.5 \text{ tubercles} \pm 0.9$ (range 20–27) and in ♂ with $22.5 \text{ tubercles} \pm 1.7$ (range 17–27).

Preabdomen. – Dorsally blackish brown, pollinose, base more whitish pollinose; terga 2 and 3 anterolaterally with whitish pollinose spots; tip (centre of tergum 4 and tergum 5) also whitish pollinose (fig. 64); syntergum consisting of terga 1, 2 and 3, seam between terga 2 and 3 distinct; sternum 1 dark brown, pollinose; sternum 1 basally fused to syntergum.

Female postabdomen. – Deflexed, terga 6, 7 and 8 rectangular plates (fig. 65); basal half of tergum 8 (fig. 66) glabrous; tergum 10 with four pairs of hairs, cerci broad, ratio of length/width 1.9, covered with microtrichia and a number of hairs (fig. 66); sterna 5 and 6 single rectangular sclerites (fig. 65); sternum 7 angular anteriorly and constricted medially posterior-

ly; sternum 8 a single, triangular to V-shaped sclerite; spiracle 7 in membrane; subanal plate (figs. 66–67) somewhat pentagonal with rounded corners, posteriorly nine pairs of hairs; spermathecae (fig. 68) rounded and smooth; genital ring (fig. 69) rounded.

Male postabdomen. – Terga 5 and 6 single plates; sterna 4 and 5 single rectangular sclerites; sternum 6 represented by two small triangular plates; sternum 7+8 a very short, band-like sclerite; spiracles 5 and 6 in membrane, spiracle 7 located rather dorsally, anteriorly of sternum 7+8; perandrium (fig. 70) rounded, with about 20 pairs of hairs, covered with microtrichia; gonostyli rectangular in lateral view (fig. 9), ratio length/width 2.3, in posterior view apically pointed, distal third on outer side covered with microtrichia, on inner side glabrous with only microtrichia on apical edge, on outer side some short hairs on apical half; gonostyli interconnected via thin processus longi; cerci very slender, ratio length/width 7.6, somewhat triangular, covered with microtrichia and hairs; phallapodeme (fig. 71) rather slender, anterior arm hardly broadening anteriorly and hardly longer than posterior arm; ejaculatory apodeme (fig. 72) somewhat abruptly broadening anteriorly.

Diagnosis

Eurydiopsis subnotata gives its name to the *subnotata* complex and can be recognized by its wingpattern (almost hyaline apex, very small hyaline spot in marginal and submarginal cell), almost uniform distribution of microtrichia on the wing, depression in front of ocellar tubercle, pollinose frons, minuscule IVB, medium-sized OVB, small but distinct facial teeth, slender front femora, long scutellar spines (25% of body length), syntergum 1+2+3, rectangular ♀ tergum 8, medially constricted ♀ sternum 7, pentagonal subanal plate, broad female cerci, single male sternum 5, rectangular gonostyli with ratio length/width of 2.3, distal third of outer side of gonostyli covered with microtrichia, slender and somewhat triangular ♂ cerci and phallapodeme with almost equal-sized arms.

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FIRST PALAEARCTIC RECORD OF THE GENUS *LAURYPTA* EDWARDS (DIPTERA: KEROPLATIDAE)

Matile, L., 1999. First Palearctic record of the genus *Laurypta* Edwards (Diptera: Keroplatidae). – Tijdschrift voor Entomologie 141[1998]: 241-244, figs. 1-5.[ISSN 0040-7496]. Published 1 March 1999.

The genus *Laurypta* Edwards is recorded for the first time from the Palearctic region, where it is represented by two species, *L. exserta* Ostroverchova (comb. n.), from the Russian Far East, and *L. tripotini* sp. n. from South Korea, which is described and illustrated. *Laurypta* belongs to the afrotropical-oriental track, which has extensions to the Eastern Palearctic and the Northern Australasian. No other genus of Keroplatidae follows this same track, which can be dated from the Miocene.

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Key words. – Diptera; Keroplatidae; Palearctic; new species; new combination; biogeography; afrotropical-oriental track.

Laurypta was described by Edwards (1929) as a subgenus of '*Platyura* Meigen', now *Orfelia* Costa. The species included in the subgenus were *Platyura leptura* Edwards, the type species, from the Malay Peninsula, *P. tripunctata* Senior-White, from Sri Lanka, and *P. laevis* Enderlein, from the Seychelles. Colless (1966) described *Orfelia* (*Laurypta*) *apicalis* from Palau Island, thus recording *Laurypta* for the first time from the Australasian Region. Matile (1970) added a further Afrotropical species, *Orfelia* (*Laurypta*) *scalaris* from Cameroun, and later recorded it from Central African Republic (Matile 1974). *Laurypta* was formally erected at generic rank by Matile (1988a) in a paper recording *L. scalaris* from Ivory Coast and Congo, and citing an undescribed species from Senegal. The genus had thus up to now an Afro-oriental distribution with an extension in the Australasian. In a collection of Keroplatidae from south Korea recently sent by M. Pierre Tripotin, stood several specimens of Orfeliini belonging to an undescribed species of this genus. This is the first record of *Laurypta* for the Palearctic Region. The distribution of the genus is given in fig. 1.

As already pointed out (Matile 1988a), *Laurypta* is well characterized by a number of apomorphic traits such as the loss of the veins Sc₁ and An and of the outer tibial spurs, the regular disposition of the tibial setulae, the reduction in number of the tibial setae, the mediotergite bearing a group of strong bristles, but none of these characters are exclusive for the genus inside the tribe Orfeliini. On the other hand, the lengthening of the male tergite IX, cerci and hypoproct, and also of the gonostyles, these four parts each being

longer than the gonocoxal synsclerite, may be considered autapomorphic for the genus (for a cladistic analysis of the characters of the Keroplatidae, see Matile 1990). Pending a generic revision of the Orfeliini, the sister-group of *Laurypta* cannot be ascertained.

The new species described here is very close to *Platyura exserta* Ostroverchova, 1979, from the Russian Far East (Sikhote-Alin Reserve, Russian Maritime Province), which was later attributed to *Pyraula* Edwards (Krivoshchina & Mamaev, 1988), and keyed in this genus by Zaitzev (1994). This species also belongs to *Laurypta* [comb. n. : *Platyura* (Z.) *exserta* Ostroverchova, 1979: 40 and plate 8, fig. 5].

DESCRIPTION

Laurypta tripotini sp. n. (figs. 2-5)

Type material. – Male holotype: South Korea, Posok-sa temple (Keumsan), Malaise trap, 30.05.-4.06.1998. – Paratypes: 2♂, 3♀; 1♂ and 2♀: same data as holotype. 1♂: same data but 26-30.05.1998. 1♀: Sanan Ili (Keumsan), very dry clearing, Malaise trap, 20.viii.1997. All material, collected by P. Tripotin, in Muséum national d'Histoire naturelle, Paris.

Male holotype. – Length of wing: 2.9 mm. Head: occiput ochreous with a silvery pruinosity according to angle of light. Three ocelli, the outer ones far from eye margin, ocellar callus black brown. Antennae: scape, pedicel and basis of first flagellomere yellow,

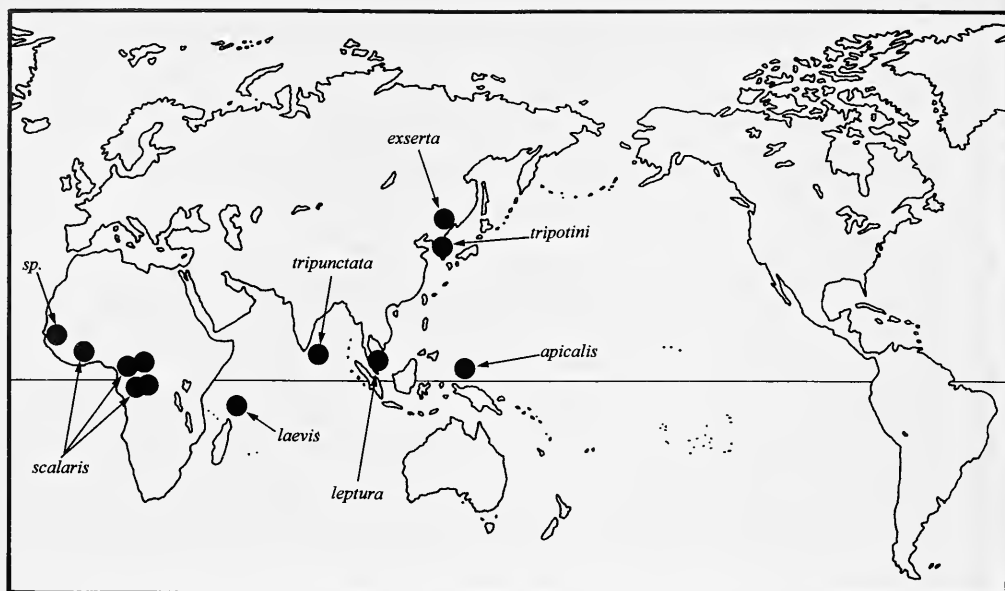


Fig. 1. – Distribution of the genus *Laurypta*.

rest of flagellum black brown. Face and clypeus ochreous, mouthparts and palpi black brown.

Thorax: humeral calli pale yellow. Scutum ochreous, bearing four small, indistinct, prescutellar brownish spots. Scutellum brown, mediotergite yellow, brown in middle at level of insertion of macrochaetae. Laterotergite brown dorsally, pleura yellow. A small brownish spot on the mesanepisternite, at level of insertion of a group of minute hairs. Metepisternite also with a patch of short hairs.

Legs yellow, tibial spurs 1:1:1, black. Tibia and protarsus I of equal length.

Wings yellow, with a faint apical spot under apex of R_1 . C reaching the tip of the wing, strongly produced after R_1 . Sc very short, ending in costa well before R_s , Sc_2 absent. R_4 very short, ending after the middle of the R_1 - R_2 interval (3:2.4). Radiomedian fusion a little shorter than R_s . Anal absent. Halteres yellow, darkened at tip.

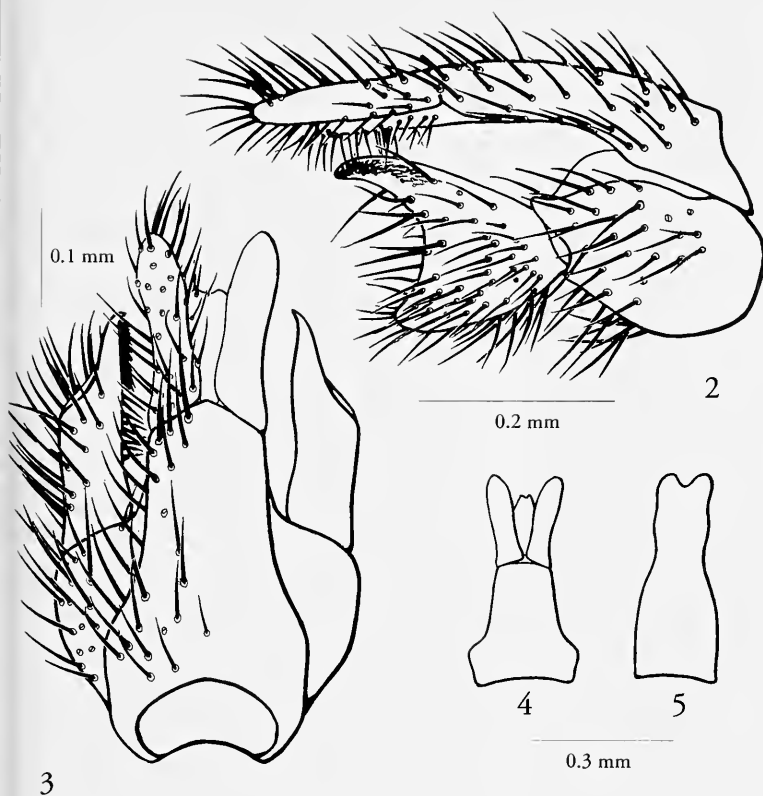
Abdomen: tergite I ochreous, the following tergites ochreous with a wide apical brown band. Sternites ochreous. Terminalia: tergite IX and synsclerite yellow, proctiger and gonostyles brown.

Male genitalia (figs. 2-4). – Ninth tergite long, wider in the basal third, extending far distad of the gonocoxite margin. Cerci long and narrow, extending distad of apex of gonostyles, hypoproct shorter, not reaching apex of cerci. Gonocoxites entirely fused ventrally, the ventral margin of the synsclerite smoothly curved inwards. Synsclerite entirely open dorsally, the internal margin bearing, on each side, a short process

bearing four closely appressed short spines. Gonostyles bifid, the ventral lobe wide, the dorsal one narrow and bearing at the internal margin rows of stronger and shorter setae. Aedeagus small and weakly sclerotized.

Female as the male, but the brown apical abdominal bands narrower. Terminalia brown black, cerci small, one-segmented, blunt at apex.

Remarks. – The male genitalia are of the usual *Laurypta* type (see drawings by Edwards 1928, for *L. leptura*, and Matile, 1988a for *L. scalaris*), and obviously very close to those of *L. exserta* (Ostr.). The types of the species described by Ostroverchova cannot be borrowed (Ostroverchova pers. comm.), but according to the sketch she gave of this species, *L. tripotini* differs by the ninth tergite wider at base (compare fig. 4, *L. tripotini* drawn under the same angle and magnification than fig. 5, *L. exserta* after Ostroverchova), and the gonostyles wider and straighter. The Korean species further differs from *L. exserta* by the scutum ochreous instead of brown black and the abdominal tergites V-VII banded instead of uniformly dark. Ostroverchova also mentions the presence of Sc_2 and of an anal vein 'well developed but not reaching the wing margin' – as stated above, the absence of Sc_2 and An are diagnostic of the genus *Laurypta*, and the two species are so close in male genital structure that I suspect a confusion between Sc_2 and humeral crossvein h, and between An and Cu_1 (on the other hand, these venation characters would check with the previous assignment of *exserta* in *Pyratula*).



Figs. 2-5. *Laurypta* species – 2, *L. tripotini* sp. n., male holotype, postabdomen, lateral; 3, ditto, dorsal; 4, ditto, proctiger and ninth tergite, dorsal; 5, *L. exserta* (Ostr.), proctiger and ninth tergite, dorsal (after Ostroverchova).

DISCUSSION

In his diagnosis of *Laurypta*, Edwards (1929) states the mesanepisternite as bare. *L. laevis*, *scalaris*, *leptura*, *apicalis* and the undescribed species from Senegal all show the patch of minute mesanepisternal hairs mentioned in the description of *L. tripotini*. The presence of metepisternal hairs has not been noted either by Edwards and the diagnosis of the genus should thus be amended.

In the keys to the genera of Keroplatinae given by Hutson *et al.* (1980) or Zaitzev (1994), *Laurypta* would come close to the genus *Orfelia* Costa, from which it differs conspicuously by the absence of outer tibial spurs, by the rows of tibial setulae all alike and the anal vein absent.

L. apicalis (Colless), described on a single damaged female, differs strikingly from the other *Laurypta* by its pictured wings, the pattern of which resembles the New Caledonian *Dimorphelia* Matile. The holotype was kindly examined for me by Dr. Raymond J. Gagné (USNM): there are 14 flagellomeres (normally 12 in

females of *Dimorphelia*, but I have seen specimens with 13), and there are anepisternal setae which escaped Colless attention. The mouthparts are pointed, but shorter than the combined length of the first two palpomeres (reaching the last palpomere in *Dimorphelia*), the anal vein is absent (faint in *Dimorphelia*) and the metepisternite is bare, so that *L. apicalis* is most probably correctly placed in the genus.

The genus *Laurypta* thus follows an afro-oriental track, with two extensions, one Eastern Palaearctic, the other Australasian. The presence of a few Oriental elements in the Japanese and Eastern Asian fungus-gnat fauna has been signalled by Okada (1938a, b, 1939), while discussing certain species. The relations between afrotropical, oriental and australasian Sciaroidea have been briefly discussed by Matile (such as 1988a, b, 1990 and 1992). On more general grounds Croizat (1958, 1964) has stressed the importance of an 'axis of dispersal: 'Eastern Siberia/Japan-Java, etc. [with ...] an East African outlier' (1964: 512), which is typically that of *Laurypta*, with lacunae which will probably be

filled in the future.

The Oriental-australasian track corresponds to two periods, Miocene and Pliocene-Pleistocene (Holloway & Jardine 1968); the fact that the distribution of *Laurypta* includes also the Afrotropical region implies that the genus is at least of Miocene origin; the extension to Eastern Asia could be as recent as the Pliocene.

Of the 49 known genera of Orfeliini, 27 are endemic to one biogeographical region, 4 are Holarctic [*Asindulum* Latreille, *Macrorrhyncha* Winnertz, *Palaeoplatyura* Meunier (living in North America, fossil in Baltic amber) and *Platyura* Meigen], 4 are Austro-neotropical (*Planarivora* Hickman, *Pyrtaula* Edwards, *Rypatula* Edwards and *Taulyrpa* Edwards), one Afro-oriental (*Ralytupa* Edwards) and one Afro-neotropical (*Lyprauta* Edwards, but there may be a Palae-arctic species, *Platyura oberthueri* Matile). *Pyrtulina* Matile is Afro-australasian, with probable Oriental representatives. The other 11 genera cover at least three biogeographical regions, but *Laurypta* is the only one showing the distribution discussed above, although a phylogenetic analysis of certain genera may in the future reveal such relationships among species-groups inside genera. None of the genera of Macrocerinae or of Keroplatinae Keroplatini show a *Laurypta*-like distribution. The 'oriental group' of the genus *Heeropterna* does follow a similar track, but its phylogenetic relationships are unsatisfactorily resolved (Matile 1990). Although there are a few other Oriental elements in the far Eastern Palaearctic Sciaroidea (Okada op. cit., Matile unpubl. data), these remain therefore anecdotal.

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